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U. S. DEPARTMENT OF AGRICULTURE

Potential Effects of ST. LAWRENCE SEAWAY on Costs of Transporting Grain

Marketing Research Report No. 319

U. S. DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service Marketing Research Division

PREFACE

This study of the effects of the St. Lawrence Seaway on the costs of transporting United States grain is part of a broad program of research by the Agricultural Marketing Service, U. S. Department of Agriculture, to improve the marketing of agricultural commodities.

There is much interest among producers, operators of country and terminal elevators and terminal markets, carriers, and other groups in the influence the St. Lawrence Seaway will have on grain transportation routes and marketing channels.

This report compares the charges to shippers and the costs to transportation agencies for transporting grain from selected areas of production to domestic markets, and also to foreign markets, via the St. Lawrence Seaway and via other routings. A comparative analysis indicates the transportation benefits that the St. Lawrence Seaway can provide, and defines the tributary areas affected.

ACKNOWLEDGMENTS

This study was made possible through the cooperation of shippers, stevedoring companies, carriers, grain exchanges, boards of trade, and chambers of commerce, who gave freely of their time and provided the basic information for the study.

Mrs. Beulah A. Whittington and Ralph O. Foster, Transportation and Facilities Branch, Marketing Research Division, gave invaluable assistance in the processing and tabulating of data.

Washington, D. C. April 1959

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Washington 25, D. C. - Price 75 cents

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SUMMARY

Parts or all of 17 States fall in the area tributary to the Great Lakes-St. Lawrence waterway. The States are Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, New York, North Dakota, Ohio, Pennsylvania, South Dakota, Wisconsin, and Wyoming. These States account for over 75 percent of the total annual production of wheat, corn, barley, oats, rye, sorghum grain, soybeans, and flaxseed in the United States. Much of the grain moving to deficit areas in the United States, as well as to foreign markets, originates in the 17-State area.

During the period 1945-54, an average of 395,179,000 bushels of grain was exported annually to countries located so they can be served economically by the Great Lakes-St. Lawrence-ocean route. The countries are in western Europe, the Mediterranean area, Africa, the Middle East, the Caribbean area, and along the east coast of South America. This export volume is 69 percent of our total average annual grain exports of about 571 million bushels during 1945-54.

Savings in grain transportation charges to overseas markets because of the Seaway should be substantial, and should be available on shipments from inland elevators. On shipments to western Europe through the port of Rotterdam, Netherlands, savings are available for 14 of 19 inland points covered by this analysis. On shipments to the Mediterranean, the Middle East, and contiguous areas through the port of Casablanca, Morocco, there are savings for 15 of the 19 shipping points; and to the east coast of South America through the port of Santos, Brazil, for 7 of the 19. Circuity of routing restricts the areas from which grain can be shipped economically via the St. Lawrence Seaway to South America.

The maximum potential savings, as computed in cents per bushel are:

On wheat from Duluth to Rotterdam, 17.23 cents; to Casablanca, 17.74 cents; to Santos, 20.31 cents.

From Chicago to Rotterdam, 17.52 cents; to Casablanca, 18.04 cents; to Santos, 20.61 cents.

From Toledo to Rotterdam, 12.90 cents; to Casablanca, 13.42 cents; and to Santos, 15.99 cents.

The Great Lakes-St. Lawrence waterway provides the most economical export route for grain from a broad hinterland area in the Midwest, with overseas movement either in Liberty vessels, purchased at low war-surplus-disposal prices, or in modern lake-ocean bulk carriers, purchased at current prices. Costs of moving grain in oceangoing vessels direct from lake ports, filling out to full ocean draft with cargo at Montreal, are lower than costs of grain transportation from the same lake ports in "upper lakes" boats with transshipment in oceangoing vessels from Montreal.

The ability of the Welland Canal to handle prospective traffic expeditiously depends on the rate of replacement of smaller vessels now transiting it by the more economical larger vessels. The canal has ample inherent capacity to accommodate the estimated 1968 traffic of 50 million tons of all commodities, upbound and downbound, if larger vessels dominate the bulk cargo movements.

The differentials in transportation costs favoring the Seaway route are expected to result in the construction of grain storage facilities on the lower St. Lawrence River or at other Canadian ports where harbors are open year-round. From these ports, United States grain can be exported during the period when navigation is closed by ice on the Great Lakes and the Seaway. But because of many factors, now unmeasurable, that will bear upon the amount of United States grain that may move out through the Seaway, it is unsafe to estimate what that amount may be.

Unless railroad rates are substantially reduced on grain shipments from producing areas to ports on the Great Lakes, increasing volumes of grain will move to those ports in motortrucks or barges. Substantial margins exist between railroad rates and computed fully-distributed and out-of-pocket railroad costs; also between barge rates and barge costs. The Seaway may influence carriers to reduce grain rates, since it will provide nearby deep-water navigation to the grain belt.

A considerable volume of the export grain that has moved through Gulf ports will find an outlet at lower transportation costs via the Great Lakes-St. Lawrence Seaway route. Unless railroad rates on grain to Atlantic Coast ports are reduced, much of the export grain formerly moving through these ports may be diverted to the Seaway route. This assumes that port harbors on the Great Lakes are deepened to accommodate vessels loaded to full Seaway draft.

On the basis of computed costs, there appears little prospect of economical use of the Seaway route soon for movement of grain from lake ports to Atlantic Coast ports for domestic use.

POTENTIAL EFFECTS OF ST. LAWRENCE SEAWAY ON COSTS OF TRANSPORTING GRAIN

By Robert C. Haldeman, transportation economist,
Marketing Research Division, Agricultural Marketing Service

INTRODUCTION

Construction of the St. Lawrence Seaway by Canada and the United States, along with deepening of connecting channels between the Great Lakes, provides a modern navigation facility for oceangoing vessels to and from the heart of our continent (fig. 1). While numerous factors, including electric power development, formed a basis for the project, justification for the navigation improvements rested largely on anticipated savings in costs of transporting large volumes of freight to and from the area economically tributary to the Great Lakes-St. Lawrence waterway. The estimated traffic volume was used in computing the probable toll revenue for use of the Seaway facilities, and the enabling legislation approving this project called for self-liquidation of the costs of constructing, operating, and maintaining the improvements within 50 years.

Projected annual United States and Canadian grain tonnage for the Seaway was estimated in 1954 by the U. S. St. Lawrence Seaway Development Corporation at 12 million net tons (2,000 pounds). This constitutes a substantial part of the corporation's estimate of all traffic for 1959--36-1/2 million net tons. (64)[1] This estimate of grain tonnage assumes a considerable diversion of grain traffic to the Great Lakes-St. Lawrence waterway from former routings. On the basis of lower transportation costs, prices received for grains at the farm may be higher or delivered grain prices may be lowered. The position of both the United States and Canada in the export grain market may be enhanced, although any lowering of delivered grain prices resulting from use of the Seaway probably would be met by other exporting countries.

The self-liquidating St. Lawrence Seaway improvements, increasing the minimum channel depth from 14 feet to 27 feet between Lake Ontario and Montreal and increasing the minimum Welland Canal depth to 27 feet, between Lakes Ontario and Erie, were scheduled for completion about the middle of 1959. Improvements being made by the United States out of tax funds, designed to increase minimum channel depths between other Great Lakes to a 27-foot minimum, probably will not be completed until 1962. Vessels plying the Great Lakes above Lake Erie will face channel depth restrictions, limiting sizes of cargoes, for several years longer than those vessels calling at Lake Erie and Lake Ontario ports. However, this restriction is not too severe, since a minimum upbound channel depth of 21 feet and a minimum downbound depth of 25 feet are already available. The greater downbound channel depth is designed to accommodate heavily laden vessels carrying ore from the Mesabi region bordering Lake Superior.

This analysis assumes the completion of channels to a 27-foot minimum depth. Although harbor depths are less than this minimum at many Great Lakes ports, the study assumes harbor depths will be made available comparable to the minimum 27-foot channel depth. The study assumes also that transportation charges reflect transportation costs, including a reasonable profit.

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[1] Underlined figures in parentheses refer to items in References, page 55.

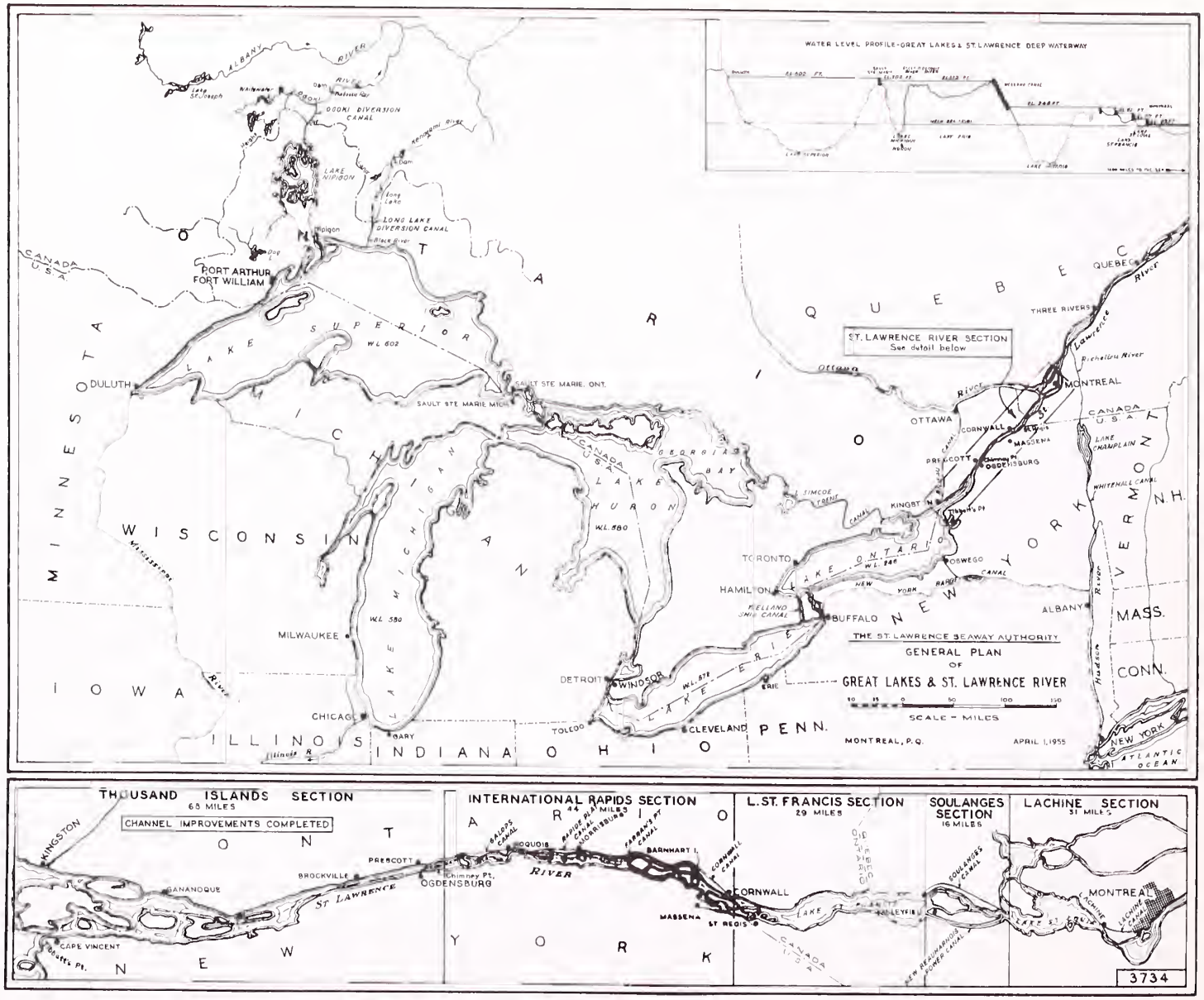

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Figure 1. --Great Lakes-St. Lawrence waterway.

The computed costs to the carriers, representing the various modes of transportation for moving grain with the Seaway in use, are determined and compared with charges to shippers before completion of the Seaway. The cost comparisons, are assumed to reflect the actual economy of transporting grain by the particular carrier or carriers between specific origins and destinations. The difference between computed carrier costs and charges to shippers provides an indication of the extent to which charges might be reduced should competition bring about a reduction of charges to the computed cost level. The transportation analysis covers the movement of grain in domestic as well as export marketing channels.

Transportation is a link between producer and consumer. The modernized Great Lakes-St. Lawrence waterway is essentially a new link. A determination of its effects on grain transportation costs depends on what grain-producing areas it can economically serve in reaching grain-consuming areas. These areas are examined in the following paragraphs, along with various grain transportation routings.

GRAIN PRODUCTION: GREAT LAKES-ST. LAWRENCE WATERWAY TRIBUTARY AREA

The term "grain" as used in this report includes vegetable-oil commodities, such as soybeans and flaxseed, as well as the usual classified grains: Wheat, corn, barley, oats, sorghum grain, and rye. Seventeen States were selected as representing the area potentially tributary to Seaway traffic. They are Montana, Wyoming, Colorado, North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, Ohio, New York, and Pennsylvania.

The inclusion of the total production of the last two States in this analysis does not affect the conclusions significantly, since neither State is a large producer of these commodities. The area tributary to the Great Lakes-St. Lawrence waterway covers only part of these States, and much of the area of each actually is tributary to the Atlantic Ocean.

The average production in bushels, by commodity, for the 1945-54 period, and the annual production for 1955 and for 1956 are shown in table 1. Production data for 1957 became available too late for inclusion in the computations, and 1958 figures were not yet available. For all the grains, the 17-State area accounted for 79.4 percent of total U. S. production in 1945-54, 78.4 percent in 1955, and 77.6 percent in 1956. In 1957, the area accounted for 78.0 percent of total U. S. production. The relationship of the 17-State totals, in 1957, by commodities, to total U. S. production was about the same as in 1956 except for sorghum grain. Sorghum grain at the present time is a relatively small export item.

Total grain production in 1955 and 1956 decreased from the 1945-54 averages in the following States: Wyoming, Colorado, South Dakota, Nebraska, Kansas, and Iowa. Substantial increases occurred in Montana, North Dakota, Minnesota, Missouri, Wisconsin, Illinois, Michigan, Indiana, and Ohio. Some increase occurred in New York and Pennsylvania.

Wheat

The 17 States named accounted for 71.2 percent of average annual U. S. production of wheat in the period 1945-54, 77.6 percent in 1955; and 71.5 percent in 1956. In the 1955-56 period, substantial increases occurred in Missouri and Illinois. Substantial declines from the 1945-54 average occurred in Colorado, South Dakota, Kansas, and Ohio. Of these States, only South Dakota falls within the hard red spring wheat producing area (fig. 2). It is believed by many that the St. Lawrence Seaway can have a significant effect on hard spring wheat exports, as any reduction in transportation charges is regarded as stimulating increased demand for this high-quality wheat. Production of soft red winter wheat is very heavy in Illinois, Indiana, and Ohio, which touch on the

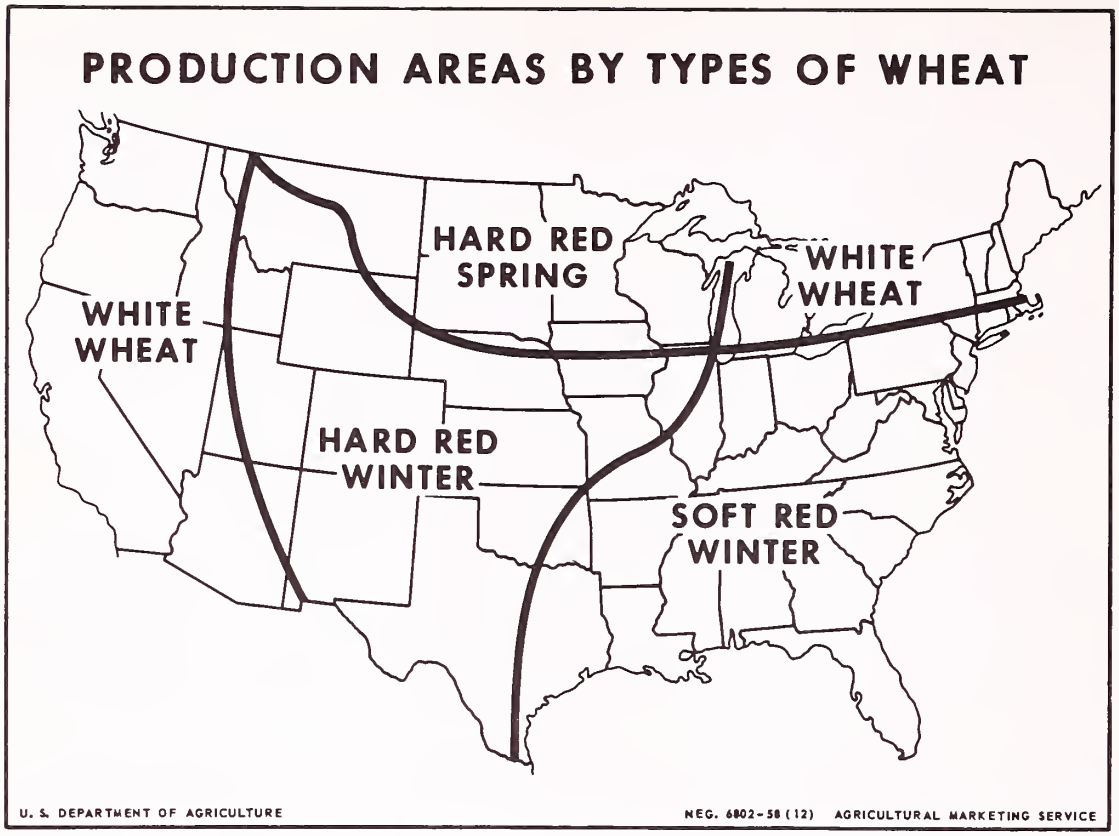

Figure 2.

Great Lakes. Table 2 shows the substantial decrease that has occurred in spring wheat exports since 1951-52.

Wheat production in the United States in relation to that of the three other major wheat exporting countries and of Europe is shown in table 3. The United States produces substantially more wheat than any other country in the world (excluding Russia). For the last 10 years, Canadian production has averaged less than half of U. S. production. The combined production of European countries exceeds that of the United States.

Corn

The 17 States named accounted for 81.8 percent of average annual U. S. production of corn in the period 1945-54; 80.2 percent in 1955; and 82.2 percent in 1956. In the 1955-56 period, substantial increases occurred in Colorado, North Dakota, Minnesota, Missouri, Wisconsin, Illinois, Michigan, Indiana, and Ohio. Substantial declines from the 1945-54 averages occurred in Nebraska and Kansas. The heaviest corn-producing States within the 17-State area, in their order of importance, are Illinois, Iowa, Minnesota, Indiana, Ohio, Missouri, and Wisconsin--all either bordering on or near the Great Lakes.

Barley

The 17 States named accounted for 60.0 percent of average annual U. S. production of barley in the period 1945-54, 58.4 percent in 1955, and 53.5 percent in 1956. In the 1955-56 period, substantial increases occurred in Montana, North Dakota, Kansas, Missouri, Illinois, Indiana, Ohio, and Pennsylvania. The heaviest producing States in

their order of importance are North Dakota, Montana, Minnesota, Missouri, and Kansas, but production in the first three is by far the more important.

Soybeans

Practically no soybeans are grown in Montana, Wyoming, or Colorado. The remaining 14 States of the 17 named accounted for 88.6 percent of average annual U. S. production in the period 1945-54, 82.7 percent in 1955, and 82.6 percent in 1956. In the 1955-56 period, substantial increases occurred in North Dakota, South Dakota, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, and Ohio. Production did not decline significantly in any of the 14 States. The heaviest producing States in their order of importance are Illinois, Minnesota, Indiana, Iowa, Missouri, and Ohio--all near the Great Lakes.

Other Grains

Oats production in the 17 States was 88.4 percent of average annual U. S. production during the 1945-54 period, 88.3 percent in 1955, and 83.4 percent in 1956. Principal producing States in their order of importance are Minnesota, Iowa, Illinois, Wisconsin, Indiana, Ohio, North Dakota, and South Dakota.

Little or no sorghum grain was grown in Montana, Wyoming, North Dakota, Minnesota, Wisconsin, Michigan, Ohio, New York, or Pennsylvania. The remaining 8 States produced 26.8 percent of average annual U. S. production during the 1945-54 period, 20.6 percent in 1955, and 24.5 percent in 1956. Significant production increases have occurred in the 8 producing States within the 17-State area. These accounted for 47.7 percent of the total U. S. production in 1957 compared to 24.5 percent in 1956. The major producing State is Texas, outside the tributary area of the Great Lakes.

Flaxseed production is limited to a few States. These are, in their order of importance as producers, North Dakota, Minnesota, South Dakota, Montana, Iowa, Wisconsin, and Kansas. These States accounted for 90.5 percent of average annual U. S. production in the 1945-54 period, 95.4 percent in 1955, and 97.5 percent in 1956.

Rye production occurs in all of the 17 tributary States. They accounted for 82.7 percent of average annual U. S. production in the 1945-54 period, 86.1 percent in 1955, and 78.2 percent in 1956. Principal producing States are North Dakota, South Dakota, Nebraska, Minnesota, Illinois, and Indiana.

The preceding analysis indicates that, for the major grains, except sorghum grain, the 17-State tributary area is the breadbasket of the United States. It is the production from this area that moves into export channels and into deficit producing areas in the United States.

CHARACTERISTICS OF INLAND GRAIN MOVEMENTS TO INTERIOR AND PORT DESTINATIONS

Grain marketing involves transportation from producing areas to flour and feed mills and to grain deficit areas in our country, and from surplus producing areas to the ports from which it is exported overseas.

Some major grain deficit areas in the United States are New England, the mid-Atlantic States, and the southeastern United States. Grain moves from the "breadbasket" States into these areas by various routings, depending largely on where the grain is produced. It moves by land or water or combination land-water routings. The actual transportation may be by lake boat, rail car, truck, or barge, or a combination of these. The important channels of grain movement to the East Coast are by lake-rail routes, during the open navigation season on the Great Lakes, and by all-rail routes.

Grain moves from Duluth and other ports on the Great Lakes to Buffalo and Oswego, N. Y., where it is transferred to rail cars for movement on to Atlantic Coast ports or into deficit grain-producing areas. Another outlet of consequence from the lakes to the East Coast ports is via the New York State barge canal (fig. 3 and Table 4).

The movement to the Great Lakes ports from production areas is largely by rail, but table 5 indicates that increasing volumes of grain are moving to Chicago, Toledo, and Minneapolis-St. Paul by truck. The increasing truck movement to Minneapolis-St. Paul foreshadows possible increased truck movement, now minor, into the port of Duluth for movement over the modernized waterway. Truck movement to St. Louis is showing significant advances. To this inland-waterway port, it totaled over 34 million bushels in 1956, or about 50 percent of the rail volume.

The inland waterway system joins the Great Lakes at Chicago and extends from there, and also from Minneapolis, Omaha, and Pittsburgh, on down to New Orleans (fig. 3). Barge movements of grain to Chicago (table 5) and to Baton Rouge and New Orleans (table 6) are large, with a generally upward trend in recent years. Table 6 indicates that barge grain receipts at Baton Rouge and New Orleans have been over 50 percent of total exports from these ports. Much of this grain originates at points on the upper Mississippi and Illinois Rivers (table 7) that will have a new export outlet.

While Missouri River grain traffic has been increasing, the absence of a fully dependable navigation channel has deterred the development of large-volume movements. Upon completion of construction of the large storage dams on the upper Missouri River and its tributaries, scheduled for the1960's, grain traffic on this waterway should show significant gains, as water released from these reservoirs will assist in maintaining a year-round 9-foot minimum channel depth for tows on the Missouri River.

Since 1942, when a 9-foot channel became available on the Tennessee River for the full 638 miles from Knoxville, Tenn., to the mouth of the river at Paducah, Ky., grain volume has increased over tenfold (table 8). This is a major artery for grain movements into the southeastern grain deficit area. This grain moves to points as far south as Florida.

Figure 4 shows the locations of grain elevators on the Mississippi River and interconnecting waterways. Many of these receive rail-delivered grain, but they also serve as assembly points for truck-delivered grain, most of which is transported from within a 100-mile radius of the elevators. However, increasing volumes are being trucked over longer distances. For example, a considerable volume moves to the Minneapolis-St. Paul area from points in the Dakotas (11); Iowa grain moves south to St. Louis and east to Chicago by truck, and Illinois and Missouri grain also is trucked to those markets (43). The ports of Toledo and Chicago compete with the Ohio River elevators for trucked grain from Ohio and Indiana (18). The direct all-water export route from the ports on the Great Lakes can result in an increasing pull of grain toward the lakes from the area north of the Ohio River.

It is apparent that a rail rate or cost analysis by itself is inadequate as a basis for determining the possible effects of the modernized Great Lakes-St. Lawrence waterway on the transportation of grain. Truck and barge operations are extensive, and must be considered in order to obtain a true picture. As a corollary, grain handling expenses must be taken into account, since different routings require different numbers of transfers and handlings with varying intermediate expenses between producer and consumer.

Is there any potential domestic market for grain transported via the Great Lakes-St. Lawrence waterway? Table 9 presents an analysis of 1956 rail grain traffic from the following States, considered tributary to the Great Lakes-St. Lawrence waterway, to New England, and to the mid-Atlantic deficit destination areas: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, New York, Ohio, and Wisconsin. These States also are used as origins for southeastern movements; and, in addition, Tennessee has been included as a source of grain for the Southeast, since a

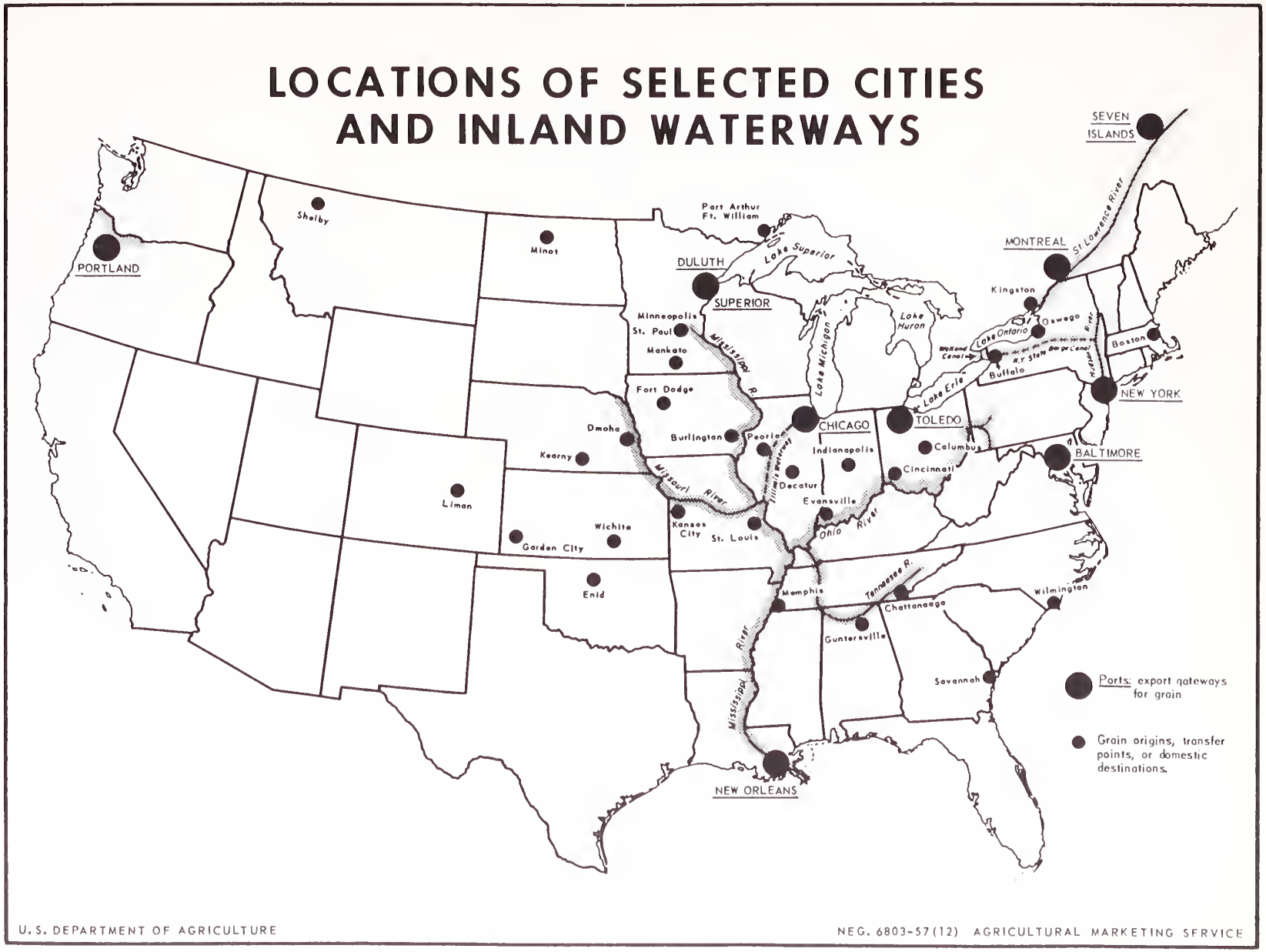
LOCATIONS OF SELECTED CITIES AND INLAND WATERWAYS
SEVEN ISLANDS
St Lawrence River
MONTREAL
Kingston
Oswego
Lake Ontario
Boston
NEW YORK
Welland Canal
N.Y. State Barge Canal
Buffalo
Lake Erie
Port Arthur Ft. William
Lake Superior
DULUTH
SUPERIOR
Minneapolis
St. Paul
Mankato
Mississippi R.
Lake Michigan
Lake Huron
Shelby
Minot
PORTLAND
Fort Dodge
Dmoha
Burlington
Peoria
CHICAGO
TOLEDO
Illinois Waterway
Indianapolis
Columbus
BALTIMORE
Kearny
Missouri River
Decatur
Cincinnati
Liman
Evansville
Kansas City
St. Louis
Ohio River
Wichita
Garden City
Enid
Memphis
Tennessee R.
Chattanooga
Wilmington
Guntersville
Savannah
Mississippi River
NEW ORLEANS
Ports: export gateways for grain
Grain origins, transfer points, or domestic destinations.
U.S. DEPARTMENT OF AGRICULTURE
NEG. 6803-57(12) AGRICULTURAL MARKETING SERVICE

Figure 3.

LOCATIONS OF GRAIN ELEVATORS ON THE MISSISSIPPI RIVER SYSTEM, 1957

UPPER MISSISSIPPI RIVER

BURLINGTON, IA.
CLINTON, IA.
DALLAS CITY, ILL.
DAVENPORT, IA.
EAST ST. LOUIS, ILL.
GREGORY LANDING, MO.
HANNIBAL, MO.
KEITHSBURG, ILL.

LA CROSSE, WIS.
LOUISIANA, MO.
MINNEAPOLIS, MINN.
MUSCATINE, IA.
OQUAWKA, ILL.
QUINCY, ILL.
RED WING, MINN.
ST. LOUIS, MO.
ST. PAUL, MINN.
SAVAGE, MINN.
URSA, ILL.
WARSAW, ILL.

LOWER MISSISSIPPI RIVER

HELENA, ARK.
HICKMAN, KY.
MEMPHIS, TENN.
NATCHEZ, MISS.
NEW ORLEANS, LA.
PORT ALLEN, LA.
VICKSBURG, MISS.

MISSOURI RIVER

GLASGOW, MO.
KANSAS CITY, KAN.
KANSAS CITY, MO.
LEAVENWORTH, KAN.
NEBRASKA CITY, NEB.
OMAHA, NEB.
ST. JOSEPH, MO.
WAVERLY, MO.

ILLINOIS WATERWAY

BEARDSTOWN, ILL.
CHICAGO, ILL.
CHILLICOTHE, ILL.
FLORENCE, ILL.
HARDIN, ILL.
HAVANA, ILL.
HENNEPIN, ILL.
HENRY, ILL.
JOLIET, ILL.
LACON, ILL.
LA SALLE, ILL.
LOCKPORT, ILL.

MORRIS, ILL.
OTTAWA, ILL.
PEKIN, ILL.
PEORIA, ILL.
SENECA, ILL.
SPRING VALLEY, ILL.

OHIO RIVER

EVANSVILLE, IND.
MOUNT VERNON, IND.
OWENSBORO, KY.
SHAWNEETOWN, ILL.

TENNESSEE RIVER

CHATTANOOGA, TENN.
DECATUR, ALA.
GUNTERSVILLE, ALA.
KNOXVILLE, TENN.
SHEFFIELD, ALA.

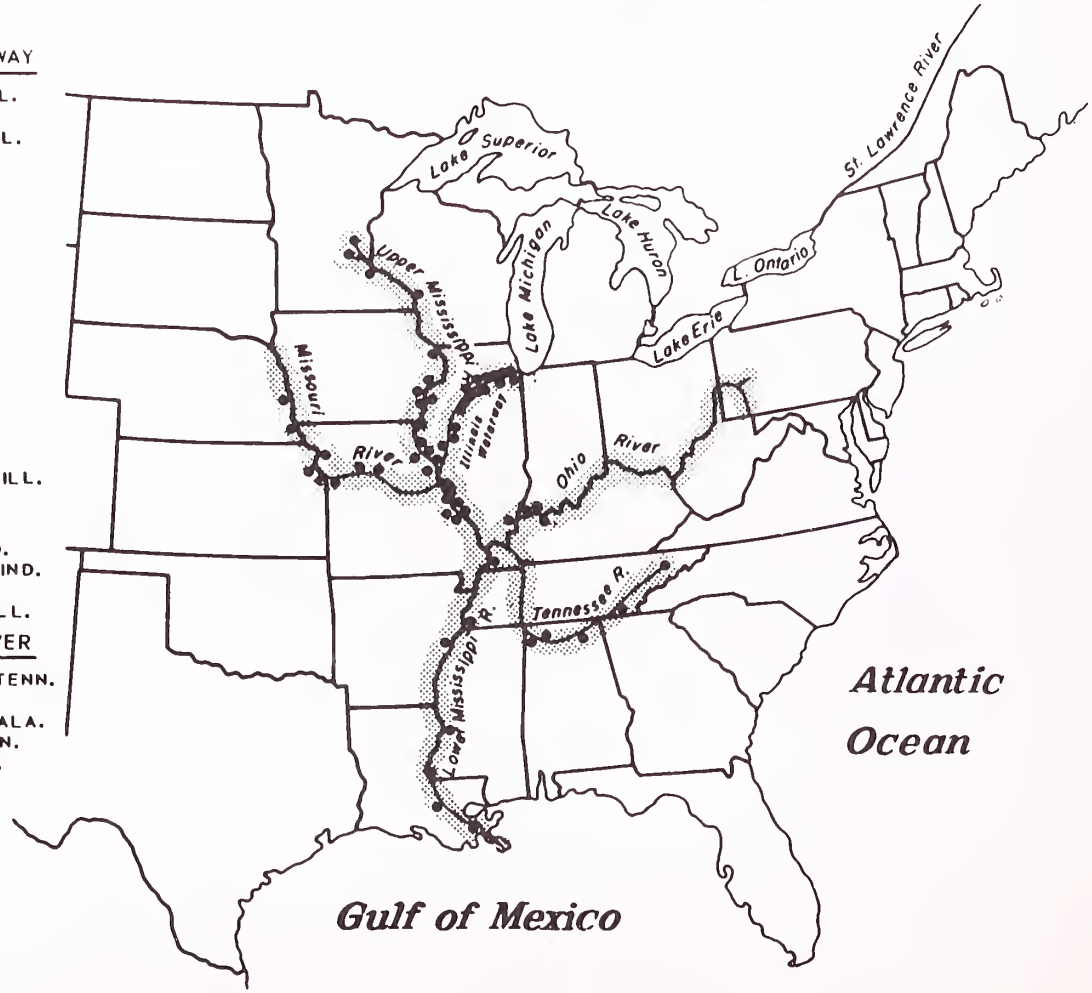

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Figure 4.

comparatively small but significant volume of ex-barge grain moves by rail from Memphis, Tenn., to southeastern States.

The destination States were selected because they either border the Atlantic Ocean or are tributary to grain marketing centers on the Atlantic Coast. For instance, Massachusetts, Maine, New Hampshire, Rhode Island, and Connecticut fall into the Port of Boston marketing area (fig. 3). The large population centers of New York, Pennsylvania, and Maryland are served by their ports, New York City, Philadelphia, and Baltimore, respectively. New Jersey, Delaware, and the District of Columbia also are served by Philadelphia and Baltimore, and Norfolk, Va., serves Virginia and adjoining areas. The two southeastern destination ports selected for the grain transportation analysis are Wilmington, N. C., and Savannah, Ga. It is recognized that adequate elevator facilities are not now available at these ports, but it is assumed that these would be constructed if traffic volume and transportation savings via the Great Lakes-St. Lawrence waterway were adequate to attract domestic waterborne grain movements into the Southeast (27) (39).

Table 10 adds to the 1956 rail movements into New England, the mid-Atlantic, and southeastern areas, the 1956 movements by barge into these areas. Included is a movement of over 17 million bushels via the New York State Barge Canal (table 4) to the mid-Atlantic area, and an estimated 11.4 million bushels to southeastern States via the Tennessee River with overland movement beyond. The 11.4-million-bushel figure is equivalent to 1/2 of the total 1956 volume of grain traffic on the Tennessee River (table 8). Total movements into New England are estimated as 33.2 million bushels; to the mid-Atlantic area, 364.4 million; and to the Southeast, 14.2 million. Except for the grain moving into southeastern States by truck from Tennessee River ports, no truck volume has been included as moving into the areas from the origin area tributary to the Great Lakes-St. Lawrence waterway. Comprehensive truck volume data are not available. Subtracting the exports moving out of these areas (table 10) results in net supplies of 10.5 million bushels to meet the New England deficit; 108.8 million bushels for the mid-Atlantic area; and 14.2 million bushels for the southeastern area. Although subject to limitations caused by lack of available data, these figures provide a general indication of the demand in the deficit areas which might be filled more economically by transportation via the Great Lakes-St. Lawrence waterway to Atlantic coast ports, thence via rail or motortruck to inland points. These possibilities will be examined in a later section of this report. In the absence of truck volume data, the net deficit figures shown in table 10 are believed to be conservative.

EXPORT GRAIN MOVEMENTS

Tables 11 through 17 present export data for the various commodities. The data consist of annual average exports in bushels for selected periods, 1935-39, 1945-49, 1945-54, 1950-54, and annual statistics for 1955 and 1956. At the time the computations were made, data for 1957 were not available. The destination areas include North, Central, and South America, Europe, Oceania, Asia, and Africa. When there were no significant export movements, as was the case for soybeans and grain sorghums before 1945-49, earlier data were omitted.

Wheat

Total exports of wheat in 1956 were over 10 times the average annual exports for the drought period 1935-39, and exceeded by some 120 million bushels, or 28 percent, the average annual exports in 1945-49 (table 11). Significant is the fact that Europe has consistently been the heaviest importer of U. S. wheat. However, other areas are assuming increasing importance as export markets. In the 1945-54 period, our average annual exports of wheat to Europe were 57.8 percent of total exports. For the 1950-54 period, the percentage had dropped to 48.8, in 1955 to 44.6, and in 1956 they were 44.9 percent of our total wheat exports. In contrast, average annual exports to Asia and Oceania have increased from 23.6 percent to the total exports for the 1945-54 period to

29.3 percent in 1955, and to 40.9 percent in 1956. Exports to North, Central, and South America, including the Caribbean area, have shown consistent gains in recent years, accounting for 11.5 percent of the 1956 total. Except for 1955, when Egypt received over 19 million bushels of wheat, our export volume to Africa has been stable at about the 15-million-bushel level.

Corn

Europe is by far the largest importer of United States corn (table 12). The average annual exports show a considerable growth in volume. From a little over 64 million bushels annually for the 1945-54 period, the volume to Europe rose above 100 million bushels in both 1955 and 1956. Canada and Mexico import substantial volumes of U. S. corn, and the volume exported to Japan has grown significantly.

Barley

Total U. S. exports of barley have fluctuated. Table 13 indicates an upward trend in exports. For example, the annual average export volumes for 1935-39, 1945-49, 1945-54, and 1950-54 show a consistent increase. The heavy export volumes of 1955 and 1956 may be out of line with overall future trends, but they do indicate the ability of this country to meet world import demands considerably in excess of past requirements.

Soybeans and Soybean Oil

U. S. exports of soybeans and soybean oil (the latter converted to a bushel equivalent) show a consistent growth to all world market areas (table 14). In 1956, the European market absorbed 62.6 percent of our total exports; Asia, 19.8 percent; and North America, 11.1 percent. Comparatively small volumes moved to South America and Africa. European imports doubled between 1955 and 1956, while Asian imports for the 2 years were about unchanged. The total export volume for 1956, over 131 million bushels, is only 13 million bushels under our corn export volume. Growth in soybean exports has been more rapid than in corn exports, and it is possible that soybeans soon may outstrip corn in volume exported.

Other Grains

Tables 15, 16, and 17 indicate that Europe is the major export market for oats, sorghum grains, and flaxseed. There has been a significant growth in the volumes of these commodities moving to Europe. Oats exports to Europe in 1956 totaled about 24 million bushels, 3 times the annual average for the 1945-54 period.

Sorghum grain exports have fluctuated, but there appears to be an increasing upward trend. Average annual export volume for the 1945-54 period was 30.2 million bushels and for the 1950-54 period was 41.2 million. In 1955, exports reached 72.8 million bushels, but in 1956 fell to 29 million.

Flaxseed and linseed oil (measured in equivalent bushels), find their largest market in Europe, with much smaller volumes moving to the Americas and Asia. The 5-year 1950-54 average annual export volume to Europe was about 9 million bushels. In 1956, the volume was over 11.6 million bushels. Export volume to the Americas has shown a significant increase, but this can be attributed to heavy Canadian imports. The volume moving to Japan, while small, shows a consistent increase in recent years.

POTENTIAL EXPORT VOLUME VIA THE ST. LAWRENCE SEAWAY

Table 18 indicates the U. S. port areas from which grain exports move. The following tabulation indicates the relative positions of the port areas, based on volume of grain exports of the North Atlantic, Gulf, and Pacific Coast areas for selected years:

	Year		
	1950	1955	1956
Port area	1,000 bushels	1,000 bushels	1,000 bushels
Atlantic	103,863	235,994	290,495
Gulf	179,778	232,210	294,187
Pacific	36,226	122,845	203,972

The dramatic increase in grain movement through Pacific ports is explained by the greatly increased imports by countries in the Far East of grain from the United States. Too, grain production in the Pacific Northwest has been increasing.

Table 2 indicates that exports of hard red spring and durum as well as soft red winter wheats move in heavy volume through Atlantic Coast ports. Hard red winter wheat moves predominantly through Gulf Coast ports, and white wheat produced in the Pacific Northwest moves from Pacific Coast ports. These movements apparently are controlled largely by the location of the production areas (fig. 2). The data indicate that the volumes of white and soft red winter wheat exports have increased significantly in recent years. Hard red winter wheat export volume has fluctuated. Perhaps most significant to this study has been the major decline in hard red spring and durum wheat exports, since these are produced in the northern tier of States west of Lake Superior. These types of wheat command premium prices and are used extensively in the manufacture of domestic flour. They are comparable in quality to Canadian wheat. To the extent that high transportation costs have been a factor in the declining export trade, the Great Lakes-St. Lawrence waterway may be a stimulant to demand and, in turn, increased production. Soft red winter wheat grown extensively in the areas immediately south of the Great Lakes also should benefit from the modernized waterway.

The analysis included in this study indicates that the destination countries and areas shown in table 19 represent the export market area for United States grain that, on the basis of comparative transportation costs, could move by the St. Lawrence Seaway. The average annual exports from the United States for the 10-year period 1945-54, to the specific countries falling in this export market area, totaled 395,179,000 bushels.

As indicated previously in the discussion of U. S. grain production, the area generally considered tributary to the Great Lakes-St. Lawrence waterway (table 1) produced substantial percentages of U. S. production of the selected commodities during 1945-54. The commodities are wheat, 71.2 percent; corn, 81.8 percent; barley, 60.0; soybeans, 88.6; oats, 88.4; sorghum grain, 26.8; flax, 90.5; and rye, 82.7. Application of these percentages to the average grain export volumes, shown in table 19, results in a U. S. potential export volume from the 17-State area to the designated export markets via the Seaway of 208,564,000 bushels. The average annual movement to countries that can be served by this waterway, as noted above, was 395,179,000 bushels during 1945-54. Although it is not known how much of this export volume actually originated in the 17-State area, production figures indicate that more than enough grain is available there to satisfy any export demand that may reasonably be anticipated for movement over the St. Lawrence Seaway.

The actual annual volume of grain exports on this route may not reach 208,564,000 bushels. The physical limitations of the Great Lakes-St. Lawrence Seaway route, including the closed navigation season in winter, probably will restrict traffic. However,

should the transportation economies of using this routing in relation to contemporary charges via other routes, be sufficient, a large amount of the total annual grain exports might move during the navigation season either directly to foreign destinations, or to ports with year-round open navigation for storage and subsequent shipment overseas in winter. This study indicates substantial economies in transportation charges. As a result, the annual export grain traffic via the Seaway may become a considerable portion of the potential 208,564,000 bushels. The actual volume of exports depends not only upon the level of transportation charges and the physical limitations of the waterway, but also upon other factors beyond the scope of this study.

Certain channel, harbor, and navigation-season limitations of the Great Lakes-St. Lawrence waterway have been mentioned. In the following sections, the waterway and its physical limitations are described.

THE GREAT LAKES-ST. LAWRENCE WATERWAY

The map of North America (fig. 1) shows that the Great Lakes-St. Lawrence Waterway (52) comprises:

(1) All of the five Great Lakes, namely, Lakes Superior, Michigan, Huron, Eries, and Ontario, with their connecting waterways.

(2) The St. Lawrence River proper from Lake Ontario to the Gulf of St. Lawrence.

The St. Lawrence is unique among rivers of the world in that the tremendous storage capacity of the lakes within the watershed supplies a uniform flow in the river with resulting ample water supply for dependable navigation during the ice-free period. In conjunction with the Gulf of St. Lawrence, this waterway extends 2,347 miles into the heart of the Continent from the Atlantic Ocean at the Strait of Belle Isle to Duluth, Minn. The first 843 miles, between the Atlantic Ocean and the city of Quebec through the Gulf of St. Lawrence, which is salt water, terminates in a tidal estuary extending to the city of Quebec. The St. Lawrence River from Quebec to Lake Ontario, about 342 river miles, is characterized by hundreds of islands, and the slope is broken by numerous rapids which, under original conditions, were severe barriers to navigation. From the foot of Lake Ontario to Duluth, the sailing distance is 1,162 miles, and to Chicago 1,061 miles, by way of the 5 Great Lakes and their connecting channels.

In general, the main bodies of the Great Lakes have ample depth for all classes of navigation, but the connecting waterways in their original condition presented more or less complete barriers to the passage of sizable vessels. The connecting channels are the Niagara River, containing Niagara Falls and the Whirlpool Rapids between Lakes Ontario and Erie (the Welland Canal is used for navigation); the Detroit River, Lake St. Clair, and the St. Clair River between Lakes Erie and Huron; the St. Mary's River with the locks at Sault Ste. Marie, between Lakes Huron, and Superior; and the Straits of Mackinac between Lakes Huron and Michigan.

Lake Superior has an average water elevation of 602 feet above sea level and the St. Lawrence elevation at Montreal, about halfway between Quebec and Lake Ontario, averages about 20 feet. There is a total drop of 582 feet (fig. 1) distributed as follows:

(1) The St. Mary's River, connecting Lakes Superior and Huron, descends 22 feet.

(2) The St. Clair River, Lake St. Clair, and the Detroit River, joining Lakes Huron and Erie, descend 9 feet.

(3) The big drop, at and near Niagara Falls, between Lakes Erie and Ontario, is 326 feet, of which 167 feet is in the falls.

(4) From Lake Ontario to Montreal, the St. Lawrence River falls 225 feet. The drop in the various sections is:

a. The Thousand Islands section, from Lake Ontario downstream to Ogdensburg, N. Y., extends 68 miles. There is little drop, since this reach is esentially an arm of Lake Ontario.

b. The International Rapids section, from Chimney Point near Ogdensburg to St. Regis near Cornwall, extends 46 miles, with a 92-foot descent.

c. The Canadian section, from Cornwall to Montreal, extends 68 miles with a drop of about 133 feet.

There is a 35-foot channel from the sea to Montreal, 1,000 miles. Between the head of the Great Lakes and Ogdensburg, N. Y., 1,200 miles, natural depths in the open lakes average from 75 feet in Lake Erie to 600 feet in Lake Superior, and only in the connecting channels have there been controlling depths of 25 feet for downbound traffic and 21 feet for upbound traffic, which are to be deepened. The 27-mile Welland Canal, carrying navigation around Niagara Falls, has had a controlling channel depth of 25 feet (now deepened to 27 feet), and 5 single and 3 twinned locks, 800 by 80 by 30 feet over the sills. In the 114 miles between Ogdensburg and Montreal, Canadian canals have been a bottleneck to shipping; navigation was limited by a canal system of 22 locks, 252 feet long, 44 feet wide, and 14 feet deep.

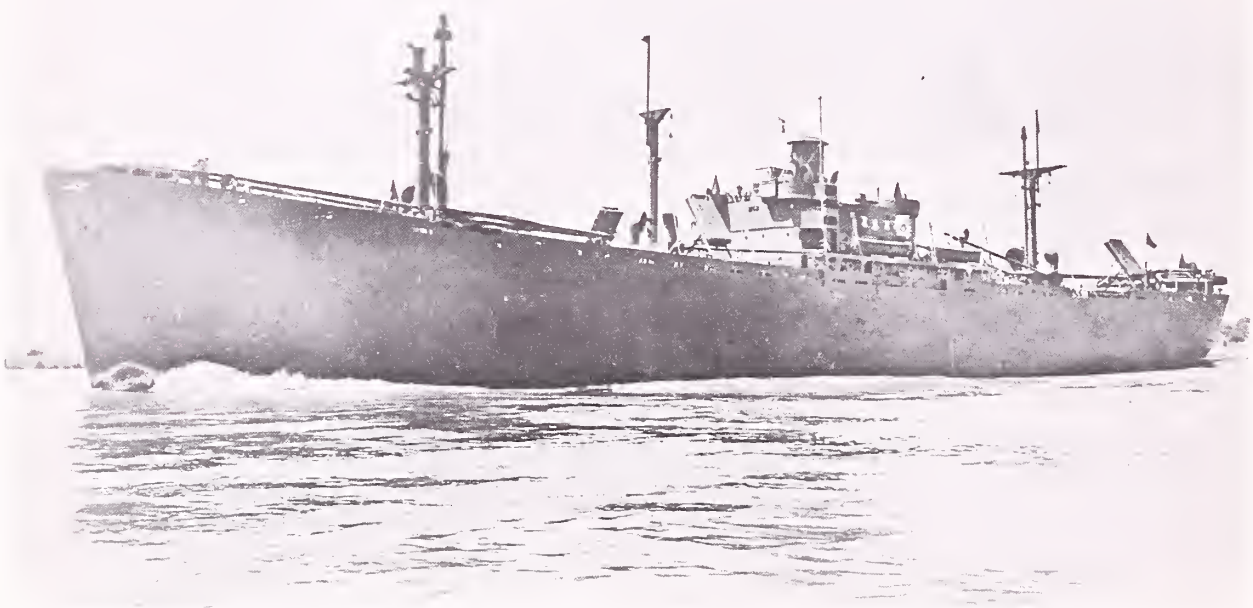
With the approval of the St. Lawrence Seaway Authority Act by the Canadian Government, December 21, 1951, and the signing of the Wiley-Dondero Act by the President of the United States on May 13, 1954, a new era of navigation was assured for the Great Lakes-St. Lawrence waterway (63).

The St. Lawrence Seaway project, between Lake Ontario and Montreal, is designed to provide a minimum channel depth of 27 feet with 7 locks, 800 feet long, 80 feet wide, and 30 feet over the sills. The 25-foot minimum controlling depth of the Welland Canal is increased to 27 feet. In March 1956, the United States Congress passed and the President approved the Blatnik Act, to bring the upper-lake connecting channels up to seaway standards (65, 67, 69). This law authorized the deepening of the Great Lakes connecting channels to 27 feet. The total estimated capital investment for the entire project is about $620 million, of which the improvements under the Blatnik Act were estimated to cost $150 million. Construction under Canadian authorizations and under the Wiley-Dondero Act were expected to be completed in 1959. Channel deepening under the Blatnik Act may not be completed until 1962.

The two agencies charged jointly by law with construction of the St. Lawrence Seaway and improvements to the Welland Canal are the St. Lawrence Seaway Authority in Canada and the St. Lawrence Seaway Development Corporation in the United States. Canada's Seaway Authority is accomplishing most of its engineering and field operations with its own personnel. The Seaway Corporation, which is supervising the activities of the Corps of Engineers, U. S. Army, in design work and field superintendence delegated to it, is operated by a small executive staff. Actual construction in either case is by contract after competitive bidding. Construction in early 1959 was reported to be on schedule. Work authorized under the Blatnik Act was under way with supervision by the Corps of Engineers, U. S. Army.

Another important auxiliary necessary to the full utilization of the waterway is the deepening of harbors, many of which have minimum depths of 22 to 25 feet. The Corps of Engineers is studying the economic feasibility of such improvements, and will make recommendations (53).

In this study to determine the possible effects of the modernized navigation facilities on the costs of transporting United States grain, it is assumed that channels and harbors are of 27-foot minimum depth, capable of accommodating loaded vessels drawing 25-1/2 feet of water. The Canadian Seaway Authority and the United States Seaway Corporation have indicated that vessels up to 730 feet in length and 75 feet in beam can use the Seaway facilities (41). In terms of vessel tonnage, this indicates that oceangoing vessels of present types, carrying up to 9,000 gross tons (2,240 pounds) of general cargo (fig. 5); "upper lakes" bulk carriers (fig. 6), with up to 25,000 gross tons of cargo; and lake-ocean bulk carriers, carrying 15,000 gross tons of cargo (fig. 7), will be able to navigate the full length of the Great Lakes-St. Lawrence waterway. In contrast, vessels that have been using the facilities from Montreal to Lake Ontario, where the channel has had a 14-foot minimum depth, could carry only about 2,800 gross tons. The larger of the "upper lakes" type of boats, plying within the confines of the Great Lakes, were able to carry up to 23,000 gross tons of bulk cargo on the existing channels. On the modernized facility, these vessels can load more heavily and navigate in protected waters all the way from Duluth to points on the Gulf of St. Lawrence. The number of locks over this reach was reduced from 31 to 16. This change, and the broadening of channels, can expedite shipments and tend to reduce navigation costs.



BN-7292

Figure 5.--Liberty vessel.

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Figure 6.--Loading grain into an "upper lakes" boat at Superior, Wis. Total storage capacity of Duluth-Superior elevators is 56,145,000 bushels, and more is planned.

BN-7294

Figure 7.--Lake-ocean bulk carrier (photograph of a scale model). It was constructed at Montreal, Can., for use in the bulk cargo trade on the Great Lakes-St. Lawrence waterway and the high seas.

PHYSICAL LIMITATIONS OF THE WATERWAY

Season of Navigation

The most important physical limitation of the Great Lakes-St. Lawrence waterway is the winter freeze. As indicated in table 20, the 37-year average season of navigation for Montreal harbor is 235 days, although since 1951 this season has averaged about 255 days. Table 21 gives a 37-year average navigation season for the St. Lawrence canals of 241 days; for the Welland Canal, 252 days; and for the St. Mary's Falls Canal, 250 days. Since 1951, these seasons have averaged about 250, 265, and 260 days, respectively.

The closing of navigation for a 3- to 4-month period each winter has significant effects on transportation costs for vessels plying the waterway. For the oceangoing vessels, employment may be found elsewhere on the high seas, but for the "upper lakes" type of boat (fig. 6, table 22), not suitable for plying the oceans, a layup period is a necessity. Many of these vessels are used for bulk commodity storage during the winter. Ship maintenance and repair may require 20 to 30 days a year, and much of this work is done during the winter.

In this analysis, a 230-day navigation season is used for boats of the "upper lakes" type. A 245-day season is used for oceangoing vessels plying between ports along the Great Lakes-St. Lawrence waterway and overseas ports, on the assumption that about 15 days will be spent on the high seas beyond the Gulf of St. Lawrence at the beginning and end of navigation. Where the transportation analysis covers movement from United States ports on the Atlantic, Gulf, and Pacific Coasts, a 345-day navigation season is used, allowing 20 days for vessel maintenance and repair.

Serious study is being given to the problem of substantially increasing the navigation season on the Great Lakes-St. Lawrence waterway. Undoubtedly, the future will bring longer navigation seasons as technology advances. In the meantime, the use of heavy icebreakers may lengthen the period of navigation. The trend has been to longer navigation seasons in recent years.

The effects of the limited season will have a bearing on the movement of grain traffic, as previously indicated. Some grain merchandisers may hesitate to divert their tonnage to a part-time facility, although there is much evidence that the grain trade expects to make extensive use of the waterway. Elevator sites on the lakes have been secured and construction of elevators and expansion of existing facilities are progressing. There may be certain effects on overland transportation agencies, which will be called upon to handle the off-season tonnage. Land transportation charges may conceivably be adjusted downward to compete with the all-water route during the navigation season, and adjusted upward during the non-navigation season. Any changes in rail charges would have to be approved by the Interstate Commerce Commission.

Capacity of the Welland Canal

Many of those familiar with the St. Lawrence Seaway improvements have contended that the capacity of the Welland Canal (fig. 1) will seriously limit the volume of traffic that can move to and from the upper Great Lakes (40). It is asserted that the prospective traffic movements used in the economic justification for the improvements cannot be accommodated because of the limited capacity of the canal (78).

The capacity of the Welland Canal is governed by two major factors--the number of lockages per season and the maximum capacity per vessel using the locks.[2] On the basis of past operating experience, the average time required per lockage with balanced 2-way traffic is 50 minutes (28). This figure would permit 28 lockages per 24-hour period,

[2] A "lockage" is the process of moving a ship into a lock, changing the water level, and moving the ship out of the lock.

or 14 lockages in each direction, with no allowance for delays. Since there are 5 single and 3 double locks in the Welland Canal system, movement through the single locks must be alternated between upbound and downbound traffic. If the single locks were twinned, then the number of lockages would be increased to 28 in each direction per 24-hour period.

At the 25-foot channel depth formerly prevailing, approximately 69 percent of the downbound lockages were canaller-type vessels with limited carrying capacity. The average freight tonnage per canaller is 2,143 gross tons. With the channel depth increased to 27 feet, it appears most likely that larger vessels of the Liberty, upper lakes, and lake-ocean bulk carrier types (figs. 5, 6, and 7 and table 22), will largely supplant existing vessels in the waterway traffic within the next 10 to 25 years. Data on vessels already built and cargoes that have been carried indicate that the average cargo of bulk commodities will be 15,000 gross tons, or greater.

The larger vessels can move at the rate of only one vessel per lockage, but the increase in vessel cargo capacity more than offsets any decrease in the number of vessels moving through the canal per season.

Table 21 shows that over a period of 37 years, the average navigation season for the Welland Canal was 252 days, while the average season since 1951 has been 265 days. The computed capacity of the canal is based on a 244-day season, representing about the maximum time when navigation will be open on the St. Lawrence Seaway and traffic through it may move to and from the Welland Canal. In effect, the use of a 244-day navigation season is conservative. On the average, an additional 21 days of open navigation each year is available to handle interlake traffic.

Using the 244-day season, a maximum of 28 lockages of 1 vessel each per day, and assuming the use of a vessel carrying an average cargo of 15,000 gross tons, the computed theoretical maximum capacity of the Welland Canal is 210,000 gross tons per day in each direction, or 51,240,000 gross tons per season in each direction.

Assuming the twinning of the remaining single locks in the Welland Canal, a 244-day navigation season, a maximum of 28 one-vessel lockages in each direction per day, and the use of vessels with a 15,000-gross-ton carrying capacity, the computed theoretical maximum capacity of the Welland Canal is 420,000 gross tons per day in each direction, or 102,480,000 gross tons in each direction per season.

The theoretical maximum number of lockages per 244-day season through the existing locks on the Welland Canal is 6,832. Because minor operating delays, weather, and the traffic pattern may decrease the available lockages, the practical maximum number of available lockages is assumed to be 5,770, or 2,885 lockages in each direction (13).

Relation of Estimated Traffic Volume to Capacity

Actual traffic through the Welland Canal in 1955 totalled 18,655,000 gross tons, of which 3,803,000 tons was upbound from Lake Ontario to Lake Erie, and 14,852,000 tons was downbound from Lake Erie to Lake Ontario. Of the tonnage downbound, 11,946,000 gross tons was destined to ports on Lake Ontario and 2,906,000 gross tons moved on through the St. Lawrence canals.

The Welland Canal's capacity to handle increased traffic generated by the St. Lawrence Seaway depends on the volume of downbound traffic that will seek passage from Lake Erie to Lake Ontario. This prospective downbound traffic includes both the strictly interlake traffic (not moving down the new Seaway) and the traffic that moves through the St. Lawrence Seaway as well as the Welland Canal.

Assuming that the 1955 downbound traffic volume on the Welland Canal, not moving through the St. Lawrence canals, continues to seek passage through the Welland Canal in 1959 with the St. Lawrence Seaway open to navigation; and assuming also that the relationship between the upbound and downbound flow of commodities through the St. Lawrence and Welland Canals generally follows the previous pattern (51), the downbound traffic in 1959 through the Welland Canal would total 28,362,000 gross tons. This would comprise 11,946,000 gross tons of downbound strictly interlake traffic and 16,416,000 gross tons of downbound traffic moving through both the Welland Canal and the St. Lawrence Seaway (tables 23 and 24).

This estimated downbound traffic includes 26,000,000 gross tons of bulk cargo and 2,362,000 gross tons of "other" cargo. Assuming that the bulk cargo moves in vessels averaging 15,000 gross tons per lockage and that the "other" cargo moves in Liberty-type vessels loaded to 60 percent of their dead weight, or in cargoes of 5,785 gross tons, the estimated Welland Canal downbound traffic in 1959 would require, during the 244-day navigation period, 74.3 percent of the practical maximum number of downbound lockages, or 62.8 percent of the theoretical maximum number. Since a considerable volume of the downbound interlake traffic included in the estimate would actually move during the additional 21-day average annual navigation period, the true percentages of utilization would be lower. Should the remaining Welland Canal locks be twinned, the capacity of the Welland Canal would be doubled.

The June 12, 1958, Report of Tolls Committee, issued by the St. Lawrence Seaway Development Corporation, states that the expected traffic on the St. Lawrence Seaway for the 9-month period of April through December 1959 is 25 million net tons or 22,321,000 gross tons. Since this period covers the usual annual navigation season, the estimate of 22.3 million gross tons represents a downward revision in estimated traffic. Not until 1962 is traffic expected to reach the previously estimated 1959 level of 32.6 million gross tons. For 1968, St. Lawrence Seaway traffic is estimated at 50 million net tons or 44.6 million gross tons. In the report mentioned, this is the maximum amount of estimated annual traffic during the 50-year repayment period for the St. Lawrence waterway improvements. It is estimated that this volume of traffic will move in 1968 and each year thereafter.

Assuming that the ratio of downbound tonnage to total traffic on the St. Lawrence Seaway remains constant (table 24) and that downbound strictly interlake traffic on the Welland Canal increases in the same ratio as estimated downbound traffic on the St. Lawrence Seaway, downbound traffic volume on the Welland Canal in 1968 would total 42.4 million gross tons. Assuming the ratio of bulk cargo to total cargo remained constant, the downbound lockages required would total 2,948. This is somewhat in excess of the computed 2,885 practical maximum number of downbound lockages, but is considerably less than the 3,416 theoretical maximum number.

It is believed any delays that may be experienced in entering the Welland Canal locks can be minimized through scheduling of vessel passages, as has been suggested by those familiar with the situation. It has been suggested that the capacity of the Welland Canal can be greatly increased by twinning lock No. 2, the only lock from which vessels are dispatched upbound and downbound into an adjacent single lock, and by the provision of additional tieup space. It is apparent that, even with the former facilities and method of dispatching, the Welland Canal has never operated at anything like its full capacity[3].

For the first few years after completion of the St. Lawrence Seaway, the small canallers and oceangoing vessels may continue to operate over the Great Lakes-St. Lawrence waterway and use the Welland Canal facilities. This may result in delays for larger vessels seeking to enter the Welland Canal locks. Eventually, these small vessels will probably be supplanted by larger ones. In fact, a considerable number of small

[3] From address to Canadian Association of British Manufacturers and Agencies by the Honorable Lionel Chevrier, Q. C., April 15, 1955.

foreign oceangoing vessels operating to and from ports on the Great Lakes have been constructed so that their cargo capacities can be substantially increased by increasing their overall lengths. The small vessels will not be able to compete with larger ships. This is brought out pointedly in the Montreal Research Council's report, "The Impact of the St. Lawrence Seaway on the Montreal Area," issued in July 1958 (32). As these vessels are replaced, delays experienced at the Welland Canal should decrease. Only if traffic increases to levels exceeding those now forecast will twinning of the Welland Canal locks be a necessity. However, as long as the smaller vessels use the Welland Canal, the availability of twin locks throughout the length of the canal would serve to increase its capacity and decrease vessel delays. In the cited report, it is stated (p. 24) that the twinning of the Welland Canal locks by the Canadian Government is not now contemplated. The report also states that the upper limits of Seaway volume are set mainly by the capacity of the Welland Canal. This latter factor seems to place a ceiling on downbound Seaway traffic at some 29 million net tons (25.9 million gross tons).

Capacity of the St. Lawrence Seaway Locks (3)

Criticism of the St. Lawrence Seaway project (fig. 1) generally has not been directed toward the capacity of the St. Lawrence Seaway locks, and as a result comparatively little has been published on this subject. A discussion of these locks is included here for comparison of their capacity with that of the Welland Canal.

The capacity of the improved Seaway is governed by the capacity of its seven single locks. Experience and model studies have shown the average time per lockage to be about 40 minutes. Using this average and assuming a 244-day navigation season, 6 days less than the average of the last 5 years, the maximum number of lockages is 8,784 per season. Taking into account such items as minor operating delays, weather, traffic patterns, and accidents, it is likely that no more than about 85 percent, or 7,422 lockages, of the maximum utilization can be obtained.

Assuming that the ratio of bulk cargoes to total cargoes is 80.5 percent, the same as the 1959 estimate (table 24), that one vessel mover per lockage, that bulk commodity movements are in average cargoes of 15,000 gross tons per lockage and the "other" commodities in average cargoes of 5,785 gross tons, the practical capacity of the St. Lawrence Seaway locks for a 244-day navigation season totals 98 million gross tons, or 49,000,000 gross tons in each direction. Table 24 indicates 2,852 lockages are required to handle the 32.6 million gross tons of all traffic in prospect for 1959. This is about 38.4 percent of the 7,422 lockages available. Since prospective movements are about equally divided between upbound and downbound traffic, the approximate 85-percent lockage utilization factor may be conservative. To handle the 44.6 million gross tons of traffic in prospect for 1968, which is the maximum annual prospective traffic for the 50-year payoff period, probably would require less than 50 percent of the available lockages. It is concluded that the maximum level of traffic moving on the St. Lawrence Seaway to or from ports on Lake Erie and the upper lakes will be governed by the capacity of the Welland Canal.

Other Physical Limitations

Other physical improvements necessary to a full utilization of the Great Lakes-St. Lawrence Waterway for grain transportation include the deepening of port harbors and the adaptation of elevator facilities to accommodate oceangoing vessels. Most of the harbors on the Great Lakes have minimum navigable depths less than 27 feet. The Corps of Engineers has an extensive study under way to determine the prospective traffic volume of these ports (53). On the basis of their findings, recommendations will be forthcoming for deepening harbors so that vessels loaded to maximum Seaway drafts may directly serve these ports. Elevators at grain shipping ports were being readied early in 1959 to serve the ocean-type vessels. Heights of many grain loading spouts were raised to the 90-foot level or higher, and the spouts lengthened so that the divided hulls of oceangoing vessels can be loaded more expeditiously and economically. New elevators designed to accommodate the anticipated increase in grain traffic were being constructed (fig. 8).

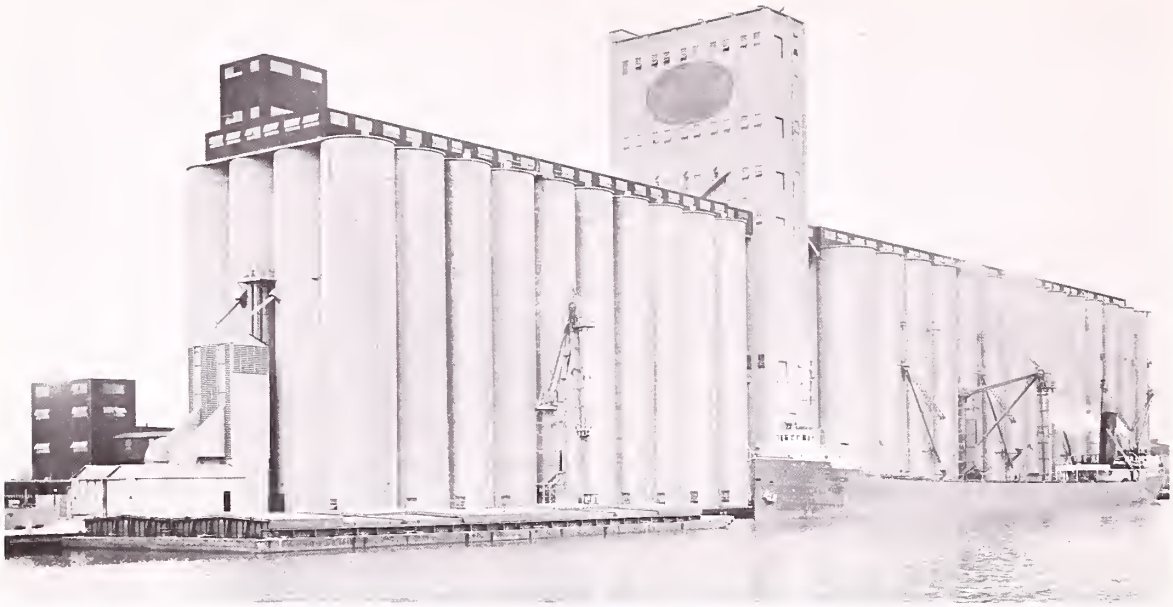

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Figure 8. --A recently constructed elevator on the Calumet River, Chicago, Ill., with storage capacity of 6-1/2 million bushels, equipped to load and unload boxcars, trucks, and all types of waterborne vessels. It can unload ships at 20,000 bushels per hour, rail cars at 15,000, and trucks at 15,000. Marine loading capacity is 50,000 bushels per hour. Two other 6-1/2-million-bushel elevators were recently completed on Calumet Harbor by the Chicago Regional Port District. These are 3 of 10 waterside elevators in the Chicago Harbor area. Chicago's total elevator storage capacity is 81,451,000 bushels; its waterside elevator capacity, 55 million bushels.

ENABLING LEGISLATION AND SEAWAY TOLLS

The Wiley-Dondero Act of May 13, 1954

The Seaway project is so set up that the cost of construction and maintenance will be paid from shipping tolls rather than being met by general taxation. Section 12 of the Wiley-Dondero Act, Public Law 358--83d Congress (63), provided that the St. Lawrence Seaway Development Corporation should negotiate with the St. Lawrence Seaway Authority of Canada an agreement on the rules for measurement of vessels and cargoes and the rates of charges or tolls to be levied for the use of the St. Lawrence Seaway, and on an equitable division between the Corporation and the St. Lawrence Seaway Authority of Canada. Such rules on charges or tolls, to the extent practicable, were to be established or changed only after due notice and a public hearing. If the U. S. authorities were unable to reach an agreement with those in Canada, the act provided for unilateral action with specific safeguards. Provision also was made for appeal of the rules and rates decided upon by the corporation. In the negotiations or the establishment unilaterally of the charges or tolls, the corporation was to be guided by the following principles:

(1) That the rates shall be fair and equitable and shall give due consideration to encouragement of increased utilization of the navigation facilities, and to the special character of bulk agricultural, mineral, and other raw materials.

(2) That rules shall vary according to the character of cargo, with the view that each classification of cargo shall, so far as practicable, derive relative benefits from the use of these facilities.

(3) That the rates on vessels in ballast without passengers or cargo may be less than the rates for vessels with passengers or cargo.

(4) That the rates prescribed shall be calculated to cover, as nearly as practicable, all costs of operating and maintaining the works under the administration of the Corporation, including depreciation, payment of interest on the obligations of the corporation, and payments in lieu of taxes.

(5) That the rates shall provide for the corporation revenues sufficient to amortize the principal of the debts and obligations of the corporation over a period not to exceed 50 years.

The St. Lawrence Seaway Authority Act (of Canada), December 21, 1951

Regarding tolls, Section 16 of the Canadian Act states:

> "The tolls that may be charged by the authority shall be fair and reasonable and designed to provide a revenue sufficient to defray the cost to the authority of its operations in carrying out the purposes for which it is incorporated, which costs shall include:
>
> "(a) payments in respect of the interest on amounts borrowed by the authority to carry out such purposes;
>
> "(b) amounts sufficient to amortize the principal of amounts so borrowed over a period not exceeding 50 years; and
>
> "(c) the cost of operating and maintaining the canals and works under the administration of the authority, including all operating costs of the authority and such reserves as may be approved by the Minister."

Provisions also were included for an agreement with the United States Government on the levels of tolls and other operating regulations.

Two conferences were held in the United States at which groups and individuals presented their recommendations and comments on the method for establishing and collecting tolls for the St. Lawrence Seaway.

The United States Tolls Committee, under the direction of the Seaway Corporation, and a similar Canadian group studied the subject of tolls further. On June 12, 1958, subsequent to the preparation of basic data for this report, the United States Tolls Committee issued a statement, in which the Canadian Tolls Committee concurred, entitled, "Report of Tolls Committee," setting forth a proposed schedule of tolls (42). For the total passage from Lake Erie to Montreal through the Welland Canal and the St. Lawrence Seaway, the suggested bulk cargo toll is 6 cents per gross registered ton, as per national registry of the vessel, applicable whether the vessel is wholly or partially laden or is in ballast. For the partial trip from Lake Ontario to Montreal, the proposed charge is 4 cents per gross registered ton, and from Lake Ontario to Lake Erie, through the Welland Canal, the proposed toll charge is 2 cents per gross registered ton.

The proposed charge per net ton of cargo, as evidenced by the ship's manifest or similar receipt or document, is 42 cents for total passage between Montreal and Lake Erie. For passage through the Welland Canal only, the proposed charge is 2 cents per net ton, and between Montreal and Lake Ontario only, 40 cents per net ton. Provisions also are made for partial transit of the St. Lawrence Seaway and for the division of tolls between Canada and the United States. In accordance with the legislative requirements, the St. Lawrence Seaway Development Corporation held public hearings on the proposed toll schedules at Washington, D. C., on August 6, 1958. Similarly, the St. Lawrence Seaway Authority held public hearings the same day in Ottawa, Canada.

This analysis includes a St. Lawrence Seaway toll of 1-1/2 cents per bushel in both the cost and the charge data. This covers the total round-trip toll charge for a vessel transiting between Lake Erie and Montreal.

Should the recommended schedule of tolls be adopted, the report cited above indicates the average round-trip toll charge between Lake Erie and Montreal, for an ocean-going bulk carrier (fig. 7), one way fully laden with return in ballast, will be 53.29 cents per net ton of cargo. For the lake boat (bulk carrier), a similar round-trip voyage would cost 50.23 cents per net ton of cargo. These charges equal 1.6 cents and 1.5 cents per bushel of wheat weighing 60 pounds per bushel.

In the following analysis, where the vessel requires passage through only the Welland Canal part of the toll waterway, both costs and charges will be understated by the amount of the Welland Canal toll charge, since this was not included. The "upper lakes" boat (fig. 6) is the sole vessel to which passage only through the Welland Canal is applicable in this study. The computed round-trip toll charge, one way fully laden with return in ballast, would total about $850, or about 13/100 cents per bushel of grain weighing 60 pounds per bushel.

The slight differences between the proposed tolls and the 1-1/2 cents per bushel included in this study have no significant effect on this analysis.

GRAIN HANDLING EXPENSES

For the purposes of this study, grain handling expenses include elevation of grain, weighing and inspection, shrinkage, and stevedoring expenses for the loading and discharging of vessels (tables 25, 26 and 27). In addition, for rail transportation, car cooperage expense is included. Elevation expense covers use of elevator facilities, and generally is a published charge by the elevator owner to cover his costs of elevating grain from a particular carrier--car, truck, or vessel--and the loading out from the elevator to the carrier. Elevator charges for the blending of grain, its storage, and other services were not included in this study. Weighing and inspection of the grain are necessary to determine the volume and quality of grain, both inbound to the elevator and outbound from it. This service is performed by State grain inspectors or by boards of trade at grain markets. The study assumes that all grain passing through any elevator is weighed and inspected both inbound and outbound.

During transporting and handling, grain may shrink in volume, because of dehydration and minor losses in transfer. As indicated in footnote 1 of table 27, shrinkage expense during vessel movement was estimated to be 3/4 cent per bushel, and during movement overland, to be 1/5 cent per bushel.

While stevedoring services are not always employed in the loading and discharging of barges, the handling expenses shown in table 27 include a factor covering this service, except where such service is covered by elevation charges. Stevedoring expenses involved in the loading of vessels at ports of export are included in daily vessel operating costs (tables 28 and 29). Where rail transportation is involved in the movement of grain, as indicated in footnote 1, table 27, a cooperage expense of $5 per carload of 1800 bushels is included in handling expenses to cover preparation of the car for loading. These handling expenses have been included in both the total charge and cost analyses.

In applying them on a per-bushel basis, it has been assumed that the indicated expenses for grain weighing 60 pounds per bushel apply to all grains. Actually, expenses per bushel for barley would be considerably less and for corn would be somewhat less, since there are more bushels per net ton for these grains. Barley weighs 48 pounds per bushel, corn 56 pounds, and wheat and soybeans, 60 pounds, although considerable variation occurs within each grain, depending on quality and dockage (foreign matter). There is some variation in total handling expenses at the locations listed in table 27, as well as variations where different modes of transportation are involved inbound and outbound. The elevation expense depends to some extent on competition for grain. The handling expenses are for the services rendered in private grain movements, although, as indicated in footnote 1, table 25, they do vary. Handling allowances made by the U. S. Government for services performed on its grain holdings may vary from the indicated expenses.

TRANSPORTATION COSTS AND CHARGES

Motortrucks

Generally, charges for the trucking of grain are not published. Most grain is hauled by the so-called "exempt" or "private" carriers (45). These carriers haul commodities on which the transportation charges are not regulated by the Interstate Commerce Commission, since they fall under the agricultural exemption clause of the Interstate Commerce Act as amended (54). Also, many carriers that haul other freight and conduct an operation that is subject to regulation by the ICC transport grain as backhaul, and this part of their business is exempt from ICC regulation. However, all carriers are subject to the safety regulations of the ICC.

In the absence of published charges, these data were secured from numerous sources (tables 30, 31, and 32). The information was divided to reflect the varying levels of charges prevailing where a round-trip payload or a one-way haul was involved. Generally, it was found that for hauls under 250 miles, a round-trip payload was not involved, but for distances over 250 miles the trucker usually had a payload in each direction. There were numerous exceptions, but the charges shown in tables 30, 31, and 32, and graphically shown in figures 9 and 10, are believed representative of those applying over a rather broad area in the Midwest and the Southeast. The basic trucking charge data are shown in table 33. Trucking charges into Portland, Oreg., are somewhat higher and are based on round-trip payloads. These are shown in figure 10.

A comparison of the level of charges prevailing for a haul of 250 miles (figs. 9 and 10) indicates the influence of backhaul in motor transportation. With backhaul, the charge is 10-1/2 cents a bushel; without backhaul, the charge is 15-1/4 cents per bushel.

The grain merchandising companies which either operate their own fleets of trucks or contract for grain hauling have fostered the construction and use of specially constructed trucks and trailers designed to carry different bulk commodities and, therefore, secure two-way payloads. These are illustrated in figures 11 and 12. The use of heavy-duty plastic bags also is being adopted by truckers, enabling them to transport bulk liquids in the same vehicles used for grain transportation. This is illustrated in figure 13. A grain elevator truck dump and the dumping operation are shown in figures 14, 15, and 16.

Along with the graphic presentations (figs. 9 and 10), charges for transporting wheat and soybeans between specific points are shown in table 30. All of the charges are based on a 600-bushel-capacity vehicle for grain weighing 60 pounds per bushel and requiring 46.5 cubic feet per gross ton of 2,240 pounds. Corn requires 49.8 cubic feet of storage per gross ton, or 107.1 percent of that required for wheat and soybeans. Charges for trucking corn (table 31) reflect the multiplication of the charges shown in table 30 by 107.1 percent. Similarly, barley requires 58.1 cubic feet per gross ton. This is 124.9 percent of the storage required for wheat and soybeans, so barley trucking charges (table 32) reflect the application of this factor to charges for transporting wheat and soybeans.

In actual practice, there is little or no difference between wheat and corn trucking charges. The differences occur when soybeans or barley is transported. The procedure used in arriving at the charges for the different grains was adopted because it is assumed that where fewer bushels are hauled, costs per bushel are higher, although often this may not be reflected in actual charges.

In the absence of any recent specific trucking cost data for grain (26), trucking charges as shown in tables 30, 31, and 32 are employed. Grain trucking, not being subject to Government regulation, is a highly competitive business in which many comparatively small operators are engaged. These factors tend to keep trucking charges close to cost levels. On the longer hauls, in which regulated carriers participate, charges are governed by comparative rail rates between any given origin and destination, by the

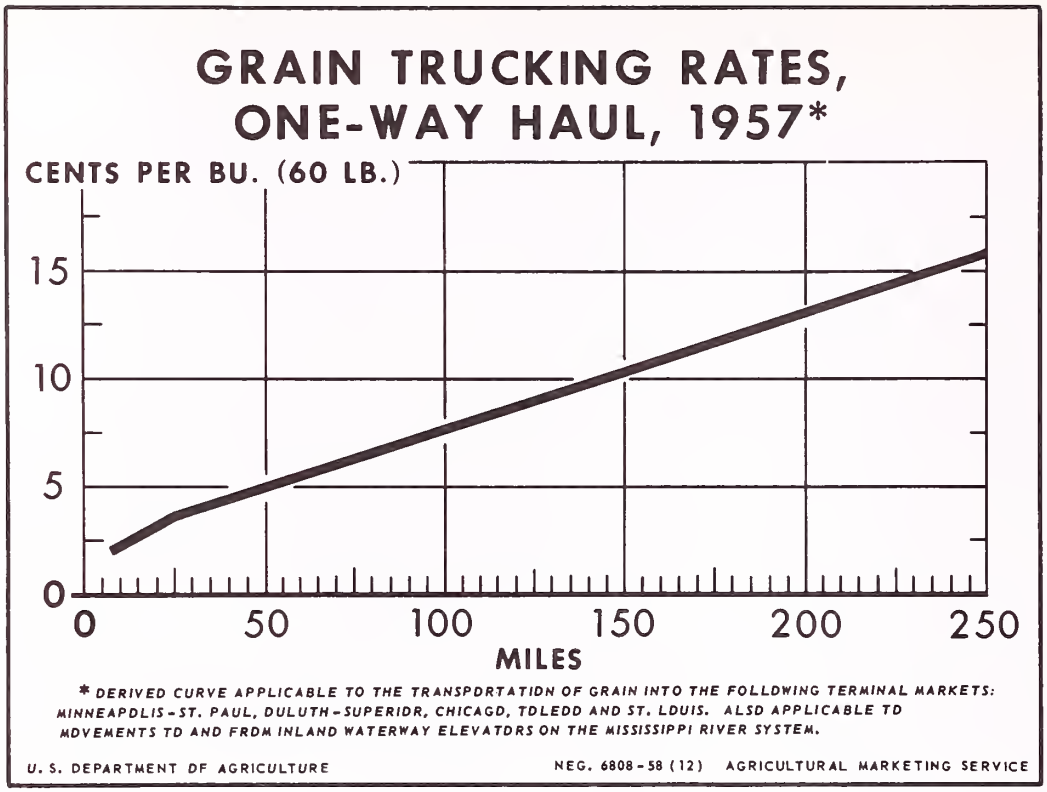

GRAIN TRUCKING RATES,
ONE-WAY HAUL, 1957*
CENTS PER BU. (60 LB.)
15
10
5
0
0
50
100
150
200
250
MILES
* DERIVED CURVE APPLICABLE TO THE TRANSPDRTATIDN OF GRAIN INTO THE FOLLDWING TERMINAL MARKETS: MINNEAPDLIS-ST. PAUL, DULUTH-SUPERIDR, CHICAGD, TDLEDD AND ST. LDUIS. ALSD APPLICABLE TD MDVEMENTS TD AND FRDM INLAND WATERWAY ELEVATDRS ON THE MISSISSIPPI RIVER SYSTEM.
U. S. DEPARTMENT DF AGRICULTURE
NEG. 6808-58 (12) AGRICULTURAL MARKETING SERVICE

Figure 9.

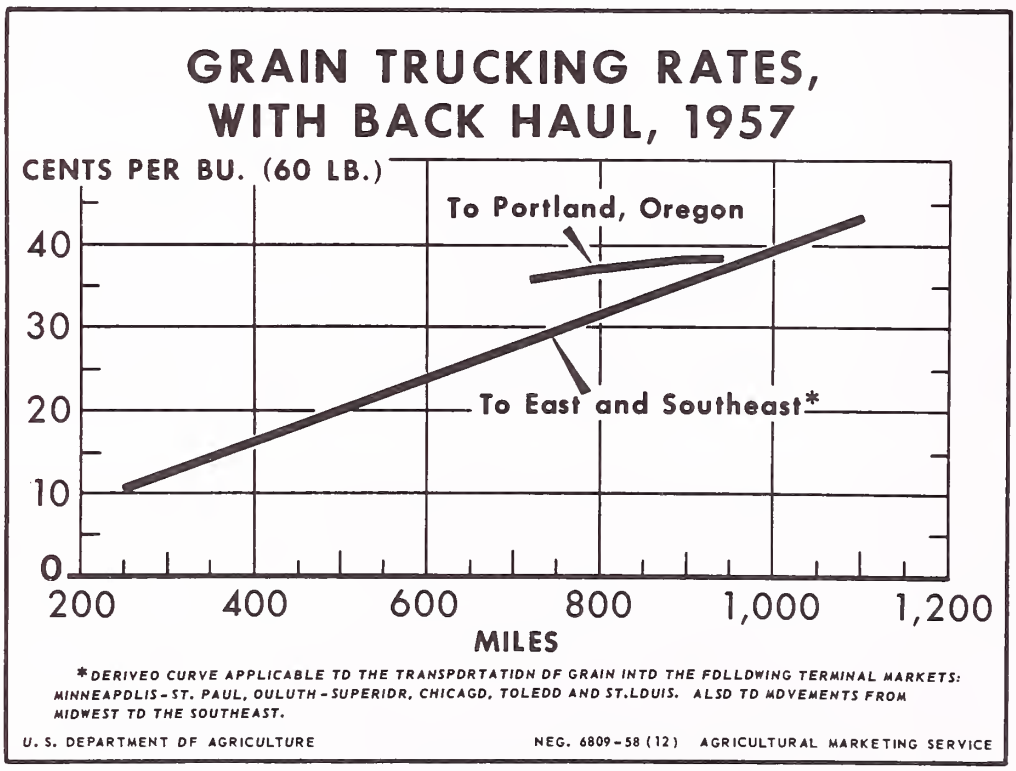
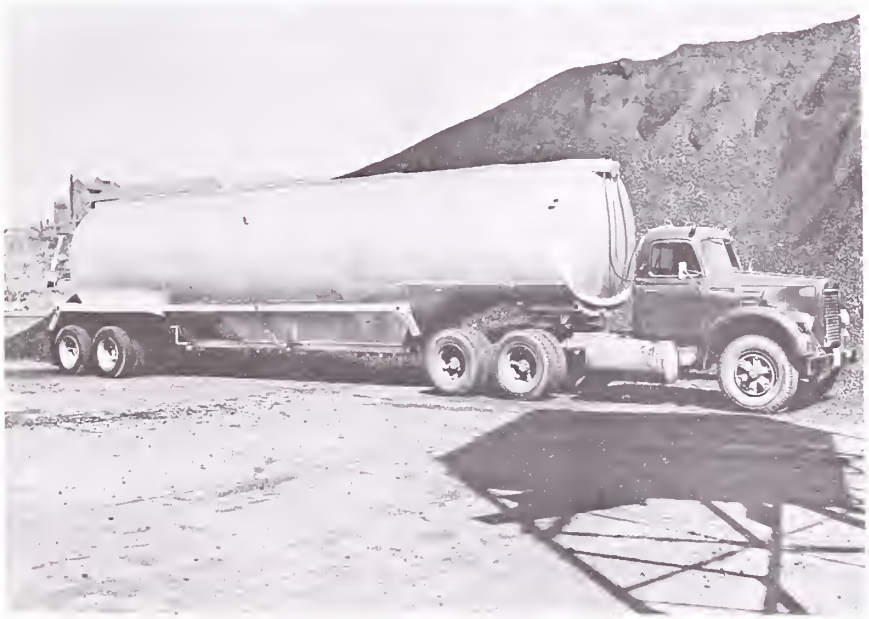


Figure 10.

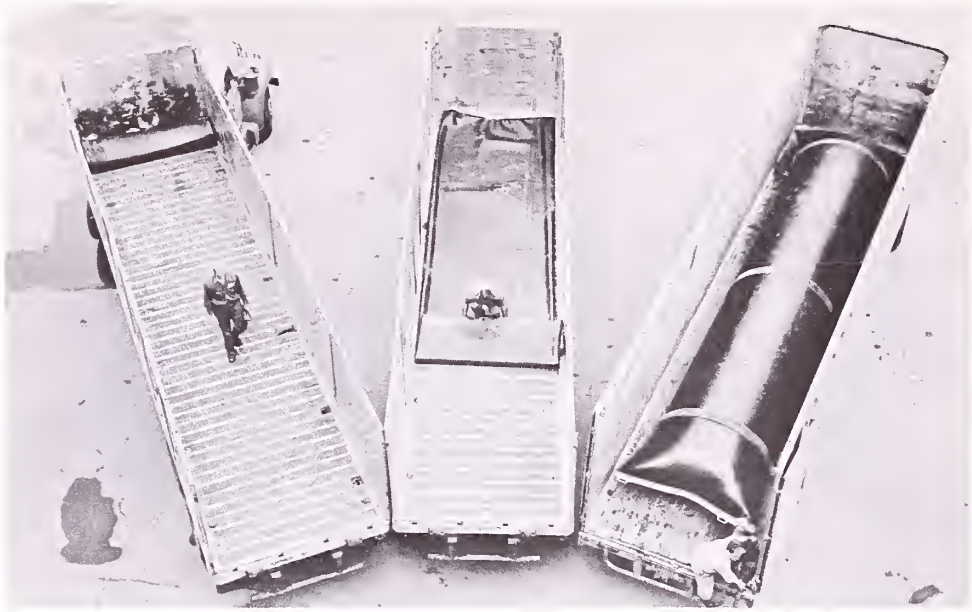
BN-7296

Figure 11. --Combination dry cargo-molasses trailer, used in the Midwest area for movements of molasses one way and return hauls of grain or coal. The grain capacity is 700 bushels; the trailer costs about $22,000.



BN-7297

Figure 12. --Combination petroleum-grain truck-trailer. It has 3 compartments--the tanks on each end will hold 6,450 gallons of gasoline; the center section is loaded through top hatches with metal covers. It is unloaded through 2 bottom hoppers equipped with sliding gates. The dry cargo compartments have a sharp slope to permit easy flow of the material. The construction is aluminum throughout.



BN-7298

Figure 13.--Giant tube permits liquid return haul in dry cargo trailer. Dry cargo one way, liquid in bulk on the return haul, with resulting lower transportation costs, is possible with the pictured large rubber bag that is carried folded in the forward end of a trailer until needed. One man can unroll it. When filled, it is 56 inches in diameter, 35 feet long, and holds 3,800 gallons of liquid. It weighs 1,040 pounds empty and its capacity when filled with molasses, for example, is 22 tons. It is filled through a fitting either at one end or at the top. After the tube is emptied, it is rolled up, and the trailer can be loaded with dry cargo for the return trip. The tube is made of 4 plies of rubber-coated rayon tire fabric moulded as is a tire. The ends are sealed by metal closures and the outer surface is made of neoprene for oil and weather resistance. The tube can be used on rail cars, barges, and vessels. Its price is about $2,000.

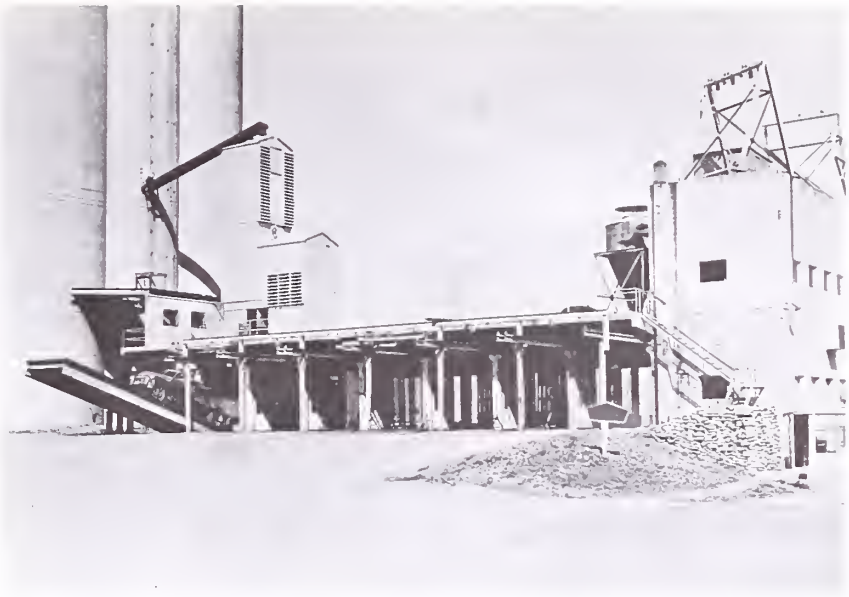
shipper's potential alternative of buying his own trucks, and by the availability of backhaul traffic. Therefore, charges for grain trucking over long distances probably do not exceed the minimum or out-of-pocket costs by any substantial margin.

Railroads

Tables 34 and 35 summarize railroad charges and estimated railroad costs between specific origins and destinations as of July 15, 1957. Since that date, when an interim rate adjustment was effective, rail grain rates have advanced 4 percent, effective August 26, 1957, and an additional 3 percent, with a minimum of 1/2 cent per hundredweight, effective December 23, 1957. Examples of the cost computations are given in table 36, based on cost data included in table 37.

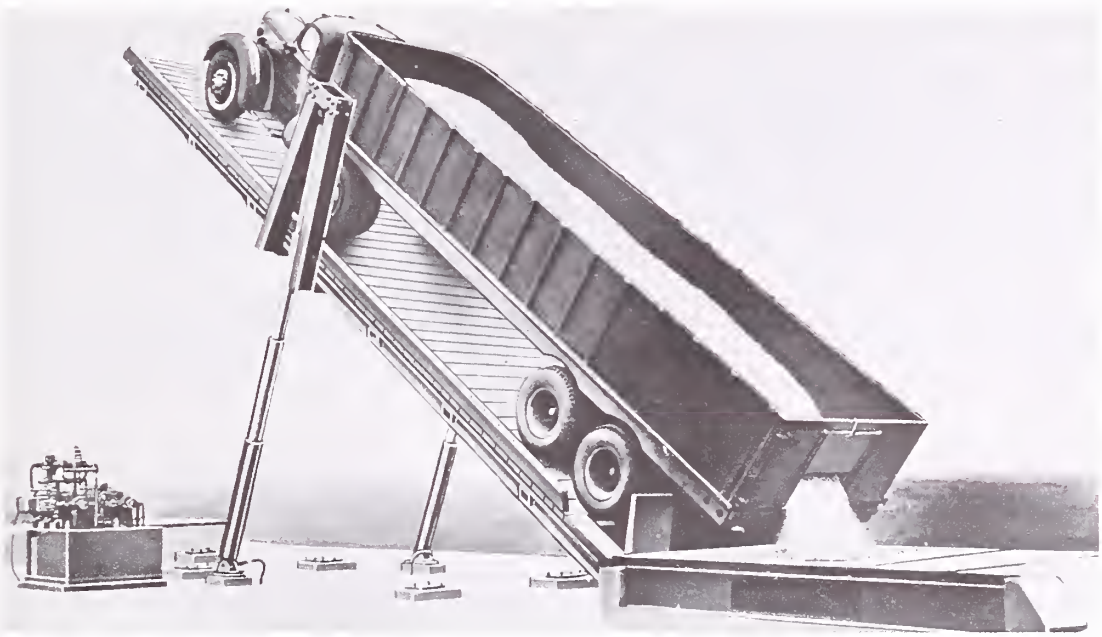
Railroad transportation of grain is subject to regulation by the Interstate Commerce Commission. Charges are regulated, and the railroads submit to the ICC copies of a 1-percent sample of all waybills covering freight movements. These waybills identify the shipment, origin, and destination, and the rates charged for the transportation. The railroads also are required to submit detailed financial statements. These data provide the ICC with information necessary in administering the Interstate Commerce Act.

Railroad costs, as included in this study, are based on data furnished by the Interstate Commerce Commission. The data included in table 37 are based on the application of costs for the year 1955 (57), adjusted to compensate for estimated changes since that time, to a 1-percent waybill sample of carload traffic for that year. For the commodities covered in this study, the costs are average costs for the use of boxcars, and they do not include any allowance for circuitous routings, under the assumption that the traffic moves by the short-line rail route. In actual practice, grain often moves over circuitous routes to take advantage of storage in transit. A boxcar on an automatic unloader is shown in figure 17.



BN-7299

Figure 14. --Grain elevator truck dump. This is 1 of 4 elevators recently constructed outside Toledo, about 10 miles from the harborside, with total storage capacity of 11 million bushels. These have excellent rail and truck-loading facilities but have access to vessels only by railroad switch. This elevator has a truck unloading capacity, through 12 truck dumps, of 150,000 bushels per day. In one 17-hour period in 1956, 1,306 trucks were dumped, hauling 256,000 bushels. Waterborne shipments are handled through an auxiliary marine leg, (fig. 22). There are 13 elevators in the Toledo-Maumee area, 4 of which are waterside facilities with over 8 million bushels storage capacity. Marine leg capacity is 60,000 bushels per hour. Total Toledo-Maumee storage capacity is about 25 million bushels. A 3-million bushel waterside public grain elevator is planned in addition to other private facilities.



BN-3919

Figure 15. --Truck in dumping position (photograph of a scale model).

BN-7301

Figure 16.--Grain flowing from a truck into a hopper-conveyor for movement into a grain elevator.

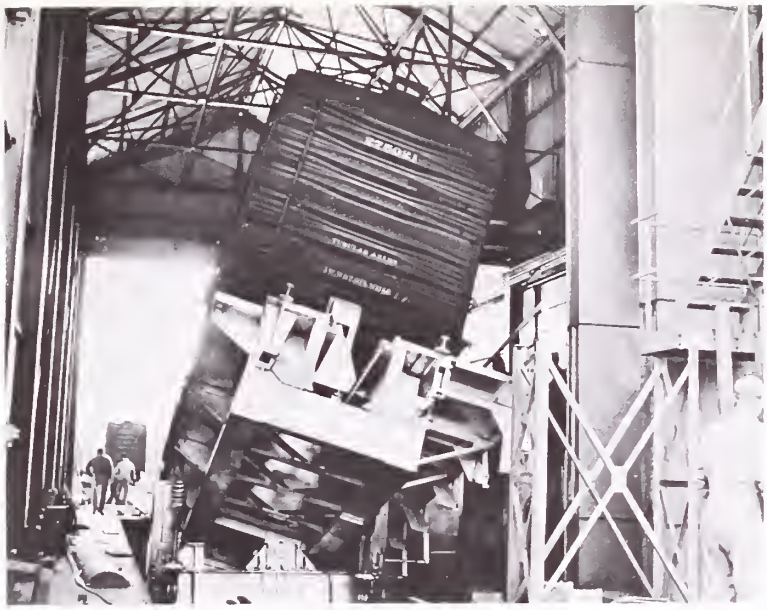
To adjust railroad costs to a 1957 level, ICC cost analysts advise that operating expenses should be advanced 13 percent over 1955 levels and that these operating expenses reflect 86 percent of the total out-of-pocket costs. The 13-percent increase was applied to 86 percent of the 1955 out-of-pocket costs, and the figures in table 37 reflect this change. The ICC also advised that constant unit costs had increased 13 percent since 1955, but this increase applies only to 60 percent of total constant costs. The figures in table 37 include this advance.

Computed out-of-pocket costs, as used in this rail cost analysis, represent those expenses which, over the long-term period, are variable with the volume of traffic handled. They include 80 percent of the railroad operating expenses, rents, and taxes. They also include an allowance for a return at 4 percent on the value of 50 percent of the road property and on 100 percent of the equipment; that is, on approximately 62 percent of the total property. The allowance for return, including the allowance for Federal income taxes, amounted to about 15 percent of the out-of-pocket costs in 1955 (57).

Constant costs represent the remaining body of operating expenses, rents, taxes, and allowance for return which are not included in the carload out-of-pocket costs just described. The constant costs also contain the deficits (or contributions) caused by passenger-train and less-than-carload services. The total constant costs were assigned to the various commodities on a pro rata ton and ton-mile basis regardless of kind or class.

The fully distributed costs refer to the sum of the out-of-pocket costs and the statistical ton and ton-mile apportionment of constant costs as described above.

Tables 34 and 35 show railroad rates and both out-of-pocket and fully distributed costs for the movement of grain between points used for comparison in this study. In respect to these costs, a word of caution is necessary when they are compared with rates. Rates based solely on costs, whether they be the out-of-pocket or the more inclusive fully-distributed costs, would ignore one of the basic principles of rate making--that of differential charging (29). If rates were made without recognizing differential charging, the result would be reductions on high-grade traffic and concomitant increases on low-grade volume traffic. Historically, rates reflect a continuous interplay of economic forces so as to permit all commodities to move with the most reasonable freedom and at



BN-7302

Figure 17.--Automatic boxcar unloader. This unit gently oscillates loaded cars of grain and can empty 5 cars an hour, compared with about 13 cars unloaded each 9-hour shift by crews using power scoops.

the same time contribute adequate revenue. Revenue contribution is a function of costs, rates, and volume, and reflects not only cost factors but also the influence of demand for transportation, a value-of-service factor, and the ability of particular traffic to bear the burden of transportation charges independent of direct cost.

In the preceding discussion of cost items, the out-of-pocket designation is considerably broader than the usual interpretation of the term "out-of-pocket costs." An allowance for a return on investment and taxes generally is not covered by the term. The assumption in this study is that rates approved by the ICC will rarely fall below a level that will cover the out-of-pocket costs. In fact, in the absence of severe competition for traffic, rail rates are at levels considerably exceeding fully distributed costs, as is shown in tables 34 and 35. In other words, the grain traffic moves at rates not justified by differences in costs of performing the specific services, and makes a contribution to total rail revenue that helps to cover possible deficits in the transportation of low-rated traffic. However, it should be observed that railway grain rates cover the cost of extensive in-transit services and that they include, under milling-in-transit, the cost of transporting more valuable and lighter weight flour, feeds, and edible cereal products.

Inland Waterways

Basic cost data for towboat and barge operation on the Mississippi River and interconnecting inland waterways (figs. 3 and 18), are included in table 38. The information was furnished by the Corps of Engineers, U. S. Army--the organization responsible for the construction, operation, and maintenance of our inland waterway improvements.

The Corps of Engineers also has the responsibility for economic analyses of transportation to determine the justification for navigation improvements, and for presentation of their findings to Congress for action. To carry out this responsibility, the Corps conducts periodic surveys to determine the costs of operating towboats and barges on the inland waterways; to determine the average speeds maintained by tows; and to keep abreast of all developments affecting inland-waterway transportation. The costs shown in table 38 reflect the actual operations of 14 barge operators transporting solid grain tows

who submitted financial statements to the Corps of Engineers. These data are comprehensive, including fixed charges, operating expenses, and profit, as well as contingency allowances.

The annual operating season for towboats is assumed to be 345 days, allowing 20 days for maintenance and repairs. The annual operating season for barges is assumed to be 365 days. These periods may seem contradictory to the navigation season data presented in table 39. The annual navigation season on the upper Mississippi River has averaged 259 days in recent years, and on the Missouri River, 261 days. The Illinois River in most years is navigable the full 365 days. Actually, towboats and barges are used on other sections of the inland waterways during the winter freeze, and grain shipments that might move by barge on the rivers are then diverted to overland transportation.

Since the cost data are based on actual operations, they reflect both loaded and empty barge movements. In recent years, inland-waterway traffic volume has been growing rapidly, and many instances were cited by operators and shippers that indicated there is a general shortage of floating equipment. The Corps of Engineers indicated a barge-towboat utilization factor of 65 percent based on an unpublished study made several years ago. Probably this percentage has increased in recent years.

On the basis of information furnished by the Corps of Engineers and by the Tennessee Valley Authority at Knoxville, Tenn., an average tow of six 195- by 35-foot barges loaded with 240,000 bushels of grain requiring 46.5 cubic feet of stowage per gross ton was used in the cost analysis for all movements on the Mississippi River and interconnecting inland waterways. The average grain tow moving from the upper Mississippi River during June 1957 carried about 6,200 net tons of grain. From January through July 1957, 47 solid tows of grain arrived at Tennessee River ports, with an average of 5.5 barges in each tow. It is recognized that much larger tows are common on the inland waterways, in particular on the lower Mississippi River. On the present Missouri River channels, average tows are not this large.

The 1500-1800-horsepower towboat was selected on the advice of the Corps of Engineers. Actually, for movements of six bargeloads, a towboat with less horsepower could

BN-7303

Figure 18.--Tennessee River tow. The tow is over 1,300 feet long. It includes 21 bargeloads of grain, 1 of scrap iron, and 2 of iron and steel products. Cargo totals 22,429 tons, or the equivalent of over 500 loaded railroad cars.

be used satisfactorily, decreasing costs appreciably. However, in the interest of a conservative cost analysis, the more powerful equipment was included.

The average in-port time per trip was estimated as 48 hours. There is considerable variation, but towboats usually do not stand idle while barges are being loaded or unloaded. In actual practice, tows are delivered to a particular destination and barges left for cargo discharge. Other barges are put in tow for the return trip, and with tows arriving frequently, floating equipment time in port is minimized. In the Minneapolis-St. Paul area, smaller harbor towboats are used for assembling barges and for barge switching between river elevators and other terminals. When barges have been assembled for southbound movement at the St. Paul staging area, they move on down the Mississippi River with more powerful towboats. On the whole, it is estimated that 75 percent of the barges that take grain from the Twin Cities area have previously brought cargo into the area (fig. 19). Another 20 percent of the southbound grain barges previously carried cargoes north to intermediate ports on the upper Mississippi River. About 5 percent came empty all the way from grain terminals at New Orleans, St. Louis, or the Tennessee River, where they previously had discharged grain cargoes.

The study assumes that barges are loaded from adequate elevator storage, and that loading of a barge requires from 4 to 6 hours. In instances of direct truck-to-barge grain transfer, barges may be delayed several days in loading. Riverside transfer elevators have capacities ranging from 50,000 to 120,000 bushels (fig. 20). At terminal markets, such as the Twin Cities, Kansas City, and Chicago, elevators have much greater storage capacity. Unloading of barges requires from 4 to 6 hours, depending on the type of equipment used. The marine leg is the usual facility, but at some river ports, vacuum unloaders are employed.

A significant innovation in barge equipment, designed for a higher equipment utilization factor, is the combination grain-molasses barge, and its counterpart for overland haul, the combination grain-molasses truck. One large grain firm operates 2 integrated tows (fig. 21), each with 3 barges in tow. These have open tops with hatch covers and are equipped with bottom tank compartments. Each barge accommodates 1,400-1,600 net tons of grain, or heavier coal loads, and 1,700 net tons of molasses.

BN-7304

Figure 19.--Grain transfer facilities on the Minnesota River. Storage and handling facilities for coal, soybean oil, molasses and grain are shown. The grain is moved from storage by an escalator-conveyor system. Storage capacity is 16 million bushels of grain, and barge loading capacity is 15,000 bushels per hour. Trucked grain receiving capacity is about 10,000 bushels per hour.

BN-7305

Figure 20.--Grain elevator at Seneca, Ill., on the Illinois River, one of 18 grain-loading facilities for barges along the Illinois River. It has a storage capacity of 200,000 bushels and is equipped only to unload trucks and load barges. The transfer capacity is from 40,000 to 60,000 bushels per 8-hour day. The light-colored barge is the "jumbo" type, with a capacity of 40,000 bushels on the 9-foot navigable channels of the inland waterways. It is 195 feet long by 35 feet wide.

BN-7306

Figure 21.--Elevator and integrated tow, Guntersville, Ala. The elevator is 1 of 16 Tennessee River grain-handling facilities. The estimated investment in these plants is $15,243,000. Four of these with a present investment of $2,716,000 existed in 1945. Tennessee River grain traffic totaled 122,861 net tons in 1945. For 1957, estimated grain traffic was 1,080,000 net tons. Estimated traffic for the first 4 months of 1958 showed a 68 percent increase over the same 1957 period. The barge being unloaded is part of an integrated tow. The typical tow is composed of 5 barges, the bow and stern barges, 43.5' by 80.1', and 3 interior barges, 43.5' by 131.9'. The towboat, which fits into the stern barge, has 880 horsepower.

Average weighted tow speeds (operating time only) on the inland waterways were furnished by the Corps of Engineers:

Waterway and direction	Weighted average miles per hour
Lower Mississippi, upbound	4.7
Lower Mississippi, downbound	8.8
Ohio River, upbound	4.1
Ohio River, downbound	6.0
Upper Mississippi and Missouri, upbound	3.9
Upper Mississippi and Missouri, downbound	6.2
Illinois Waterway and Tennessee, upbound	3.9
Illinois Waterway and Tennessee, downbound	5.2

The one-way distances were computed between ports on the inland waterways, and the running times, based upon the above data, were computed and are summarized in table 40.

The cost factors in table 38 were applied to the running time and in-port time for the 6-barge tow between selected origins and destinations (table 40). It was assumed that each barge had a capacity of 40,000 bushels of grain requiring 46.5 cubic feet of stowage per gross ton. This stowage factor applies to wheat and soybeans. Corn requires 107.1 percent of stowage for wheat and soybeans; barley 124.9 percent. These percentages were applied to the computed costs for transporting wheat and soybeans in arriving at transportation costs for corn and barley. It is assumed barges carry fewer bushels of these commodities, in direct proportion to the relative stowage factors. One-way trip costs have been allocated to the one-way cargo movements.

Barge line rates were taken from published tariffs effective July 15, 1957, and are the rates applying to bargeload quantities (table 41). Data were not available on actual charges that are sometimes lower than published rates.

The relationship of barge line charges to computed costs is given in table 42 for selected destination ports. These percentage relationships are for the movements between specific origins and destinations as shown in table 41. Although there are differences in the percentage relationships, the sample is not regarded as sufficiently large to draw any conclusions from the differences. The computation does indicate that there is a wide margin between computed costs and charges, and it seems reasonable to assume that charges could be substantially reduced should competitive factors warrant. The computation may also explain in part why some large grain-merchandising firms operate their own floating equipment on the inland waterways.

Cost data were not available for barge operations on the New York State Barge Canal-Hudson River route. Table 39 indicates an average navigation season of about 240 days for the canal. Open navigation on the Hudson River usually is year-round. Table 43 shows the average rates covering all grains during 1956 for this routing from both Buffalo and Oswego, N. Y., to New York City. These rates were used in both the charge and the cost analyses where the routings were applicable.

Great Lakes

Grain and other bulk commodities moving on the Great Lakes for many years have been transported in boats of the "upper lakes" type (figs. 6 and 22). This boat is a specialty type, employed only on the Great Lakes, since it is not adapted to the open seas. It is long, broad, and comparatively low, characterized by a high ratio of stowage space to the gross cubic capacity. A statistical description of this boat is given in table 22. The Canadian upper laker of the "Thunder Bay" class was selected because it is of a representative size for this type of vessel operating on the Great Lakes, and because reasonably comprehensive cost data were available on its operation in the grain trade.

Iron ore from the Mesabi Range bordering Lake Superior has been the backbone traffic of the "upper lakes" fleet. Other commodities moved in large volumes are limestone, used in producing pig iron, and petroleum products, coal, and the grains. Great Lakes grain traffic in recent years is shown in tables 4, 44, and 45. Table 44 shows U. S. grain traffic flow from the upper lakes to the lower lakes[4], and the relatively small volume that moved on down the St. Lawrence River. The heavy volume of grain originating on Lake Superior and received on Lake Erie reflects the predominant grain movement from the head of the lakes to Buffalo, N. Y. Although minor amounts of export grain have moved direct from the upper lakes in small oceangoing vessels to foreign ports, and, in some cases, grain has been transshipped from upper lakers to these vessels at ports on the lower lakes, probably over 99 percent of all grain shipments on the Great Lakes have moved in the "upper lakes" type of boats.

Coal is the most important upbound return dry cargo (table 44), but, as indicated, some iron ore has moved upbound on the St. Lawrence River, probably from the Canadian Labrador ore fields, with small volumes reaching the upper lakes. This movement has been regarded as the forerunner of a greatly increased volume of iron ore over this routing on completion of the Great Lakes-St. Lawrence waterway modernization program, possibly supplanting in part the large downbound iron ore movement from Lake Superior.

There has been much speculation as to the share of upbound ore traffic that will be carried in "upper lakes" boats, with through navigation available from lower St. Lawrence ports. Assuming that these boats participate in this traffic, the study includes an analysis of the costs of using them for return hauls of grain.

The ports of Duluth, Chicago, and Toledo were selected as originating ports on the Great Lakes for U. S. grain shipments. It is recognized that there are many other ports on the Great Lakes important in the grain trade. These include Milwaukee, Erie, Buffalo, and others. The selection of ports was based in part on their importance as grain-marketing centers. These selected ports are at the heads of navigation on Lakes Superior,

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Figure 22.--Marine leg, Toledo, Ohio. The grain being loaded into the "upper lakes" boat has arrived by rail in hopper cars. It is dumped from the bottoms of these cars onto a conveyor-elevator from which it drops through a chute into the vessel.

[4] The upper lakes include Lakes Superior, Michigan, and Huron. The lower lakes include Lakes Erie and Ontario.

Michigan, and Erie, and serve large grain-producing areas. Lake shipments of grain from Duluth-Superior, Chicago, and Toledo are shown in table 45, as well as shipments by other modes of transportation. Although shipments from Duluth-Superior have been largely by lake, shipments from Chicago and Toledo have been largely by rail. It is reasonable to assume that shipments by lake from Chicago and Toledo will increase signigicantly after improvement of the Great Lakes-St. Lawrence waterway is completed.

Buffalo and Oswego are grain-receiving ports, as is shown in tables 4 and 46. Much of this grain goes into domestic consumption, but a large volume has moved by rail and barge to Atlantic Coast ports for export (table 10). Should the harbors at these lower-lake ports be deepened to 27 feet, it is quite possible they might become important ports for direct all-water grain movements via the St. Lawrence outlet.

The all-water routing between the head of the lakes and Montreal, at the head of present deep-water navigation, is made up of open water, canals, locks, and channels with speed restrictions (table 47). Therefore, vessels navigating this route cannot maintain the same speeds over all sections. The 12.5-knot speed of the upper laker converts to a maximum open-water speed of 14.4 miles per hour. For channels with speed restrictions, an average speed of 12.2 m.p.h. was used, and speeds for navigating through the canals and locks were those used by N. R. Danielian in the U. S. Department of Commerce study, "The St. Lawrence Survey, Part II, Shipping Services on the St. Lawrence River," published in 1941. To the total computed times, there was added 10 percent to compensate for unforeseen delays and other factors (table 48). It is assumed the upper laker will be loaded to its maximum draft of 25-1/2 feet between origin and destination. This will not be possible until harbors and connecting channels between the lakes are deepened. The typical vessel has a capacity of 623,000 bushels of grain requiring 46.5 cubic feet of stowage per gross ton (table 22).

The cost data are based on a study made by Canada Steamship Lines, Ltd., the results of which are included in Exhibit 200, entitled, "Comparative Ship Operating Costs and Revenues, Vessels Operating Head of Lakes to Kingston, for Canada Steamship Lines, Ltd.," Dec. 1, 1955, filed with the Royal Commission on the Canadian Coasting Trade (table 49).

As indicated previously, this exhibit included more recent and comprehensive data for grain transportation in the "upper lakes" type of boat than were available elsewhere. Rates for the transportation of U. S. grain on the Great Lakes are not regulated. Financial returns of those U. S. carriers operating similar vessels on the Great Lakes, and hauling numerous exempt and nonexempt commodities, as submitted to the U. S. Maritime Administration, do not provide adequate data to separate the costs of grain movements from total costs of operation. Also, much grain is transported by grain merchandising companies in their own vessels, and cost data for these operations are confidential.

Table 49 indicates that running-time costs of Canadian upper lakers in 1955 totaled $177.79 per hour. The Corps of Engineers advises that the 1955 costs of operating "upper lakes" boats of similar size under the United States flag, built in 1952 or later, totaled $150 per hour of running time. For upper lakers over 700 feet long, built in 1952 or later, U. S. running-time costs in 1955 totalled $186 per hour. These U. S. cost figures are based on the actual operations covering transportation of a variety of bulk commodities, whereas the Canadian costs apply specifically to bulk grain transportation. The study assumes that the costs of operating "upper lakes" boats under either the Canadian or U. S. flags are the same.

The basic cost data included in table 49 reflect the allocation of round-trip costs to the 1-way grain movement. They omit certain cost factors necessary to a complete analysis of transportation costs, one of which is a profit margin. When the origins and destinations are changed, (table 50), and the movement occurs over longer or shorter distances, certain additional costs must be included. Depending on specific origin and destination, these include tolls for use of the St. Lawrence Seaway, and pilotage.

To bring the cost picture up to the 1957 level, operating expenses per trip, less the estimated toll, were increased 5 percent. It was assumed that this adjustment also would compensate for any minor difference in value between the United States and Canadian dollars. To provide a satisfactory operating ratio, total operating and handling expenses, less toll, were increased 10 percent. In this study, the toll was estimated at 1-1/2 cents per bushel of grain cargo, and it was assumed this toll would be adequate to cover the grain cargo moving through the Seaway, plus the return trip of the vessel empty or in ballast (see pp. 21-22). Tugboat and pilotage service charges on the Great Lakes and at various ports are shown in table 51.

The footnotes to table 50 indicate the method used in computing the costs between Duluth, Chicago, and Toledo, as origins, and Buffalo, Oswego, Montreal, and Seven Islands, as destinations. In these computations, it is assumed that the upper laker returns empty or in ballast to the port of origin, and the round-trip costs are allocated to the one-way cargo movement. Montreal and Seven Islands are included as destinations because the analysis seeks to determine the relative economy of moving grain by upper laker to these ports and transshipping it in oceangoing vessels for movement beyond, as compared to direct shipments to the same destinations from the ports of Duluth, Chicago, and Toledo. As previously discussed, the analysis assumes also that vessels moving overseas beyond Montreal are fully loaded, requiring fill-out cargo at Montreal (fig. 23), the head of deep-water navigation on the St. Lawrence. Therefore, it is necessary to the analysis that the costs of transporting grain from upper-lake ports of origin to Montreal be known, so that they can be included in the total costs of moving a full grain cargo in oceangoing ships to specified destinations. The study seeks to determine the relative economy of moving grain to Seven Islands in "upper lakes" bottoms that transported iron ore from Seven Islands to upper-lake ports. It is assumed this grain is transshipped from Seven Islands in oceangoing vessels to world ports.

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Figure 23.--Montreal harbor. The elevator in the foreground is the property of a flour milling company. In the background can be seen 4 National Harbours Board grain elevators. Ten marine legs are available at 6 berths for unloading from ships. Three and one-half miles of conveyor galleries deliver grain to 27 berths. Twenty ships can be supplied with grain simultaneously. Marine unloading capacity is 175,000 bushels per hour; marine loading capacity, 450,000. By 1960, storage capacity will be increased from 15,162,000 bushels to 21,762,000. Marine unloading capacity will be increased to 395,000 bushels per hour, and marine loading capacity to 775,000. According to George C. Marler, Federal Minister of Transport, this $27-million expansion program will enable Montreal to compete for grain traffic of U. S. origin.

The costs of moving grain in upper lakers from ports at the heads of the lakes to Buffalo and Oswego are also essential to the analysis of the relative economy of direct shipments via the Great Lakes-St. Lawrence waterway as compared to lake-rail and lake-barge shipments to Atlantic Coast ports. Such shipments are for domestic consumption as well as export, and in the latter case, transshipment at Atlantic Coast ports to ocean-going vessels for movement overseas is necessary.

Tables 52, 53, and 54 include the results of the computations shown in table 50 and, in addition, show the 1-way costs. In these, the voyage expenses for the 1-way trip are allocated to the 1-way grain cargo movement. They are equivalent to half the operating expenses per round trip, excluding handling and tolls, plus the handling expenses and applicable tolls. The assumption is that the vessel does not return directly to the port of origin or that it has a return payload cargo, and that the expense for the return trip is met out of revenue for transporting the return load.

In tables 53 and 54, showing estimated transportation costs in cents per bushel for movements of corn and barley, respectively, the comparative stowage factors between these commodities and wheat and soybeans were used in determining the transportation costs. It is assumed fewer bushels of corn and barley can be loaded into the upper lakers, and that transportation costs per bushel, therefore, are higher.

Estimated grain transportation charges in cents per bushel over all-water routings from Duluth, Chicago, and Toledo to Montreal, Buffalo, and Oswego are shown in table 43. As indicated in footnote 1 of that table these are, of necessity, approximations, as charges vary from month to month and from season to season. However, the relative levels of charges are believed to be representative of the differences occurring for shipments to given destinations from the different origins. It is assumed these charges apply to all grains covered in this transportation analysis.

Data in table 55, showing average water freight charges on the Great Lakes for Canadian grain, indicate charges per bushel for transporting barley as being slightly lower than charges for transporting wheat, but the difference is minor, and since this study concerns itself principally with transportation costs (in contrast to charges), using the same level of charges for wheat, corn, barley, and soybeans is reasonable and has no significant effect on the overall results of the analysis.

Ocean Transportation

Grain is transported overseas either in full cargoes, usually in tramp vessels, or as part of a cargo, or a parcel, in liners. Ocean liners make regularly scheduled trips between ports, and carry general merchandise. When the latter type of cargo is less than a full cargo, they may carry grain, often referred to as "distress cargo," since the vessel has a schedule to meet and often will accept grain parcel shipments at very low rates. The volume of U. S. grain moving from the Great Lakes in liners is determined largely by the volume of general merchandise imports and exports to and from ports on the Great Lakes. This also affects the total volume of grain movements by the St. Lawrence route.

This transportation cost analysis is limited to the movement of full grain cargoes of one commodity moving in tramp vessels operated under foreign flags to foreign ports and under the U. S. flag between U. S. ports. The tramp vessel is a contract carrier and seeks out cargo wherever it may be available. It operates on no close schedules and moves about transporting the many commodities moved in international commerce. The charges it makes for moving cargo from one country to another are not subject to formal regulation. They are governed largely by anticipated cost and competition for cargo from other operators.

Most exported grain is moved in bulk, although some bagged grain is used to prevent the shifting of grain within the vessel, particularly when the vessel does not have a full grain cargo. Sacked grain may be used also to divide the bulk grain cargo from other cargo in the vessel's holds. Should bulk unloading facilities not be available in foreign

ports, grain may be sacked at destination aboard the vessel before being unloaded. This practice is followed because sacking costs are less at foreign ports. Mechanized loading and unloading of grain is the usual practice, decreasing stevedoring time (figs. 22, 24, 25, and 26). In bulk grain operations, stevedores assist in loading and unloading grain. Their work is referred to as "grain trimming." Some elevators are equipped with mechanical trimmers, often using vacuum to unload the residue grain that the marine leg or other equipment cannot reach (fig. 27). (For grain trimming charges, see table 26).

Vessels can carry grain when higher class cargo is not available because grain requires a minimum of special equipment, is clean, and will not damage other cargo. The special equipment required consists of bulkheads, feeders, and bins. While many vessels are equipped with steel centerline bulkheads in their cargo holds, in others these are constructed of wood, as are the feeders and bins. As grain cargo settles within the holds, additional grain flows from bins or feeders and keeps the holds filled, preventing shifting. These bulkheads, feeders, and bins are referred to as grain fittings, and they are usually installed in vessels by stevedoring and shipceiling companies. (For fittings costs, see table 56). When bulk grain is a usual cargo in the vessel, bulk fittings are dismantled during unloading and used again when another grain cargo is loaded. In the 1-way cost analysis, the total cost of fittings applies to the 1-way cargo, but in the round-trip cost computations, fittings costs are allocated to the number of cargoes carried during the annual shipping season.

Seasons of grain harvest vary (tables 57 and 58). At one time, this had a significant seasonal influence on the demand for grain cargo space. However, particularly in the United States and in Canada, recent grain surpluses available from year-round storage have lessened the seasonal harvesting influence on demand for cargo space. In other grain exporting countries, the season of grain harvest remains a more significant factor. Argentina and Australia, leading export nations (table 3), require their greater volume of

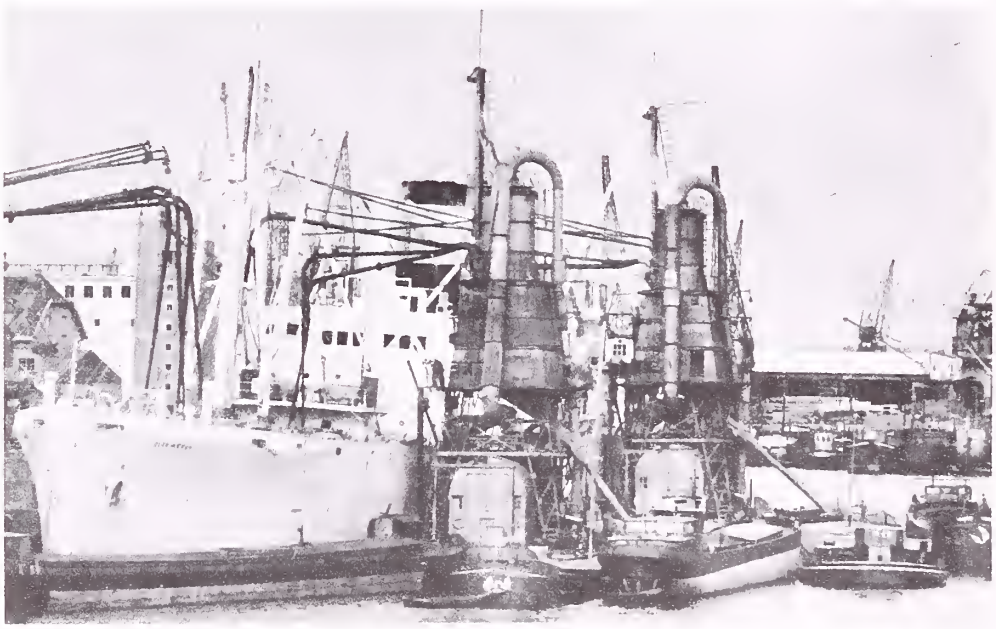

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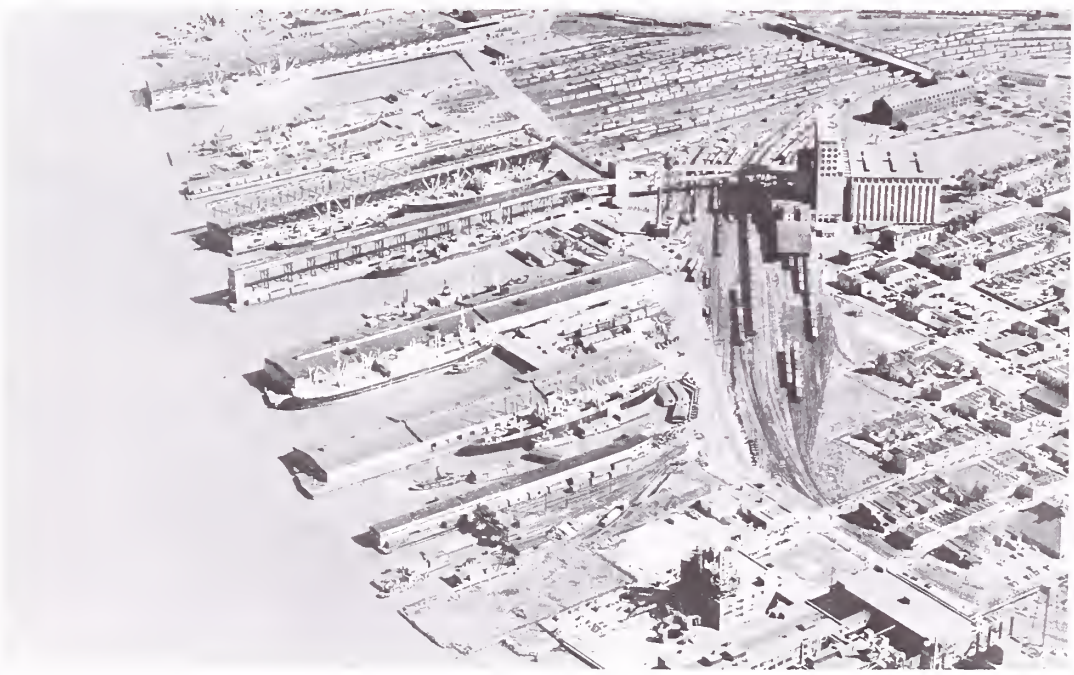
Figure 24.--Unloading grain using floating elevators. Practically all grain destined to Antwerp and Rotterdam arrives in bulk and is unloaded by floating elevators. Ships usually berth at "sphinxes" or buoys so they can discharge on both sides. Most grain is transferred directly from oceangoing freighters into barges for shipment on European rivers and canals. Much grain also is transshipped into "coasters," or small ocean ships, and moves on to Great Britain and Scandinavia. None of this grain ever goes ashore or through a warehouse until it reaches its final interior destination. The number of floating elevators working a ship depends on the number of hatches in the vessel and the number of barges available for loading. A floating pneumatic grain elevator has a working capacity of 150 to 250 tons per hour. Often 6 to 8 elevators unload from a ship simultaneously, operating day and night.

BN-7310

Figure 25.--Public grain elevator, New Orleans, La. It is owned by the State of Louisiana and operated by the Board of Commissioners of the Port of New Orleans. It has a storage capacity of 5,000,000 bushels. The unloading capacity is as follows: From cars, 29,600 bushels per hour; from barges, 36,000; from trucks, 4,800; or a total of 70,400 bushels per hour. Four belts to 2 ship berths handle 20,000 bushels each, or 80,000 bushels an hour to ships. Storage and handling capacities are being increased.



BN-7311

Figure 26.--The Baltimore and Ohio Railroad's Locust Point terminal. This is 1 of 3 modern grain elevators at the Port of Baltimore. Others are owned or operated by the Pennsylvania Railroad and the Western Maryland Railway. They have a combined storage capacity of 13,500,000 bushels and have 9 berths for ships at piers for loading. They are the largest grain elevators at any U. S. deepwater seaboard port and have a delivery capacity of about 400,000 bushels per hour.

BN-7312

Figure 27.--Wheat discharging, Rio de Janeiro, Brazil. The grain is being unloaded to elevator facilities using vacuum suckers. The rate of unloading is about 70 tons per hour, and the grain is moved about 300 feet underground to storage silos. Brazilian ports able to receive and discharge Liberty-type vessels loaded with bulk grain to full draft are Recife, Salvador, Rio de Janeiro, Angrados Reis, and Santos. The total storage capacity of the ports is about 230,000 tons. There are no public or commercial elevators except one owned by a dock company. Elevators and unloading facilities at other ports are owned by mills. Discharging time depends on storage facilities available. In many cases, vessels unload slowly for lack of boxcars or elevator space.

shipping capacity in the winter and spring. Numerous factors beyond the scope of this study influence the seasonal demand for cargo space for export grain. The study assumes that oceangoing vessels find employment elsewhere during the winter freeze on the Great Lakes-St. Lawrence waterway. A 345-day navigation season is assumed, 20 days being deducted for repair and maintenance.

The survival of tramp shipping and the huge volume of traffic carried by tramps rests fundamentally on keeping costs low. The tramp operator must have a keen knowledge of shipping and the availability of cargoes all over the world, so that his ships will arrive in ports when cargo is available and preferably where the most remunerative cargo can be found at any particular time. Operating costs must be kept at rock bottom. Therefore, vessels in the tramp trade are characterized by maximum cargo space, economical power units, and minimum investment in floating equipment.

The Liberty-type vessel, available in large numbers to private shipping after World War II, is used extensively in the tramp trade. It was made available at a small fraction of original cost. Statistics describing the EC-2 Liberty vessel appear in table 22. It operates at a maximum speed of 11 knots, and has a grain-carrying capacity at full draft--27.8 feet--of 9,500 gross tons of wheat. It is limited to about 8,500 gross tons of wheat cargo on the Great Lakes-St. Lawrence waterway from the heads of the lakes to Montreal, necessitating the taking on of fill-out cargo on the lower St. Lawrence to reach maximum salt-water draft.

Since World War II, industrial bulk carriers of 25,000 to 60,000 dead-weight tons have been constructed and have provided serious competition for the tramp operators. This type of vessel is used extensively in the petroleum and ore trades, and it may be used extensively in the grain trade, although the use of these large vessels is limited by available harbor depths and port facilities. Much grain moves to world ports that cannot accommodate such large bulk carriers. Only a scaled-down version of this type of vessel can be used on the Great Lakes-St. Lawrence waterway.

The lake-ocean bulk carrier described in table 22 represents this scaled-down version. At the time of this study, two of these vessels were operating in the ore trade from Canada to U. S. ports and to Contrecoeur, P. Q., near Montreal, on the St. Lawrence. This type of vessel is designed to operate on the Great Lakes-St. Lawrence waterway and on the high seas. It has a maximum speed of 13.5 knots and a maximum draft of 30 feet. Its wheat-carrying capacity on the waterway is 15,000 gross tons. Total capacity is 18,255 gross tons. The appearance of this vessel (fig. 7) is very similar to that of the "upper lakes" boat (fig. 6). It is a single-deck, having machinery, navigation bridge, and accommodations aft, leaving clear deck space from the bridge house front to forecastle head. The cargo spaces are subdivided into 6 cargo holds. Fuel capacity is sufficient for a radius of action of 10,000 miles.

The study assumes that this type of vessel is representative of future floating equipment that will engage in the tramp trade. The usual economic life of an oceangoing vessel is 20 years, and many of the Liberty-type vessels now in the tramp trade will be scrapped during the 1960's.

The cost analysis provides comparative figures for the Liberty vessel and the lake-ocean bulk carrier. Detailed and comprehensive cost data were available covering Liberty vessel operations. The described lake-ocean bulk carrier has not engaged in grain transportation. For this vessel, flying the United Kingdom flag, estimated cost data were secured from the builder.

Liberty-Type Vessel

Estimated 1957 daily operating costs at sea and in port for a Liberty-type vessel are shown in table 29. Data for 1955 were provided by the Corps of Engineers, and adjusted to the 1957 estimated level. Under the U. S. flag, cost per day at sea is estimated at $2,481; in port, at $2,090. In computing daily costs under a foreign flag, 65 percent of the other, or variable, costs under U. S. flag operation are included. This results in foreign-flag operating costs at sea of $1,669 daily, and in-port costs of $1,408 daily. There is a considerable variation in operating costs under different foreign flags. Operation under the Japanese flag, for instance, probably would cost less because of very low wages. The daily costs of foreign operation are believed to be representative for vessels flying European flags.

Although no differentiation is made between at-sea and in-port costs by Joseph R. Hartley in his study entitled, "The Effects of the St. Lawrence Seaway on Grain Movements," Indiana (University) Business Report No. 24, published in 1957, he indicates on page 149, table 21, that daily steaming costs and profit for a tramp of 8,000 dead-weight tons, under the U. S. flag, total $2,421, and under a foreign flag, $1,706. U. S. wages are estimated at $850 daily; foreign wages at $190 daily. The daily profit included in the Hartley estimate is $222. In the estimate in table 29, $225.58 daily profit at sea under the U. S. flag is included.

It is interesting to note that the total daily cost estimates based on data furnished by the Corps of Engineers and those in the Hartley study are about the same, assuming the latter reflect at-sea costs.

Since the vessel spends a considerable part of each navigation season in port loading and discharging cargo, the breakdown of at-sea and in-port costs is necessary and in the interest of an accurate analysis. Fuel costs per day at sea are estimated at $456; per day in port at $108. These are adjusted upward to compensate for the generally increased cost level from 1955 to 1957 and for the profit margin factor.

Lake-Ocean Bulk Carrier

As has been stated, cost data for the lake-ocean bulk carrier are somewhat sketchy, since there is no grain transportation experience on which costs can be based. However, an investment of 5-3/4 million dollars is not made in a vessel unless the future owner of

the vessel has a reasonably accurate knowledge of what the operating costs will be. These estimated costs are shown in table 28. They are included in this study to indicate grain transportation costs in a modern bulk ocean carrier as compared to costs in a Liberty vessel, now predominant in the tramp trade.

It is assumed that this vessel operates under the United Kingdom flag when transporting grain from U. S. origins to foreign destinations, and under the U. S. flag when transporting grain between U. S. ports. The estimate given in table 28 includes tug service and pilotage cost factors, not included in the Liberty vessel cost estimates (table 29).

More grain fittings are needed in the lake-ocean bulk carrier for partial cargo movements than for full cargo movements. For example, in movements from the Great Lakes ports at 25-1/2-foot draft, 2 of the cargo holds might be filled to 1/3 capacity, necessitating fittings in these 2 holds to prevent shifting of grain between the upper-lake ports and Montreal. The estimated cost of these fittings is $10,000. Where the vessel takes on a full cargo at Montreal or other deepwater ports, permitting a loaded draft of 29 feet 2 inches, the estimated cost of fittings is $3,000.

Sponsorship of construction of lake-ocean bulk carriers by U. S. interests for foreign-flag operation was probably for the purpose of competing with other foreign operators in low-cost transportation of iron ore westbound through the St. Lawrence Seaway. The vessel was not specifically constructed to handle grain, and, with some minor design changes, possibly the cost of fittings to accommodate grain cargo to the 25-1/2-foot available draft could be reduced.

The estimated total daily operating cost at sea under the United Kingdom flag is $3,217.50 and in port, $2,777.50. Under the U. S. flag, these daily costs total $4,284.50 at sea and $3,607 in port. The principal differences between United Kingdom and U. S. costs occur in wages and allowances and subsistence. Daily costs, excluding interest, depreciation, and profit, under the United Kingdom flag are 65 percent of the estimated United States costs.

Comparative Costs and Charges

Daily operating costs of the Liberty vessel (table 29) under the U. S. flag are 57.9 percent of similar U. S. operating costs for the lake-ocean bulk carrier; and, for the latter vessel, tug service and pilotage costs are included. Under the United Kingdom flag, operating costs of Liberty vessels at sea are 51.9 percent of the lake-ocean bulk carrier costs.

These differences can be attributed largely to the greater depreciation and interest costs for the recently constructed lake-ocean bulk carrier. The Liberty vessel investment was estimated at $601,800, whereas the lake-ocean bulk carrier cost is $5,750,000. Daily depreciation and interest costs for the lake-ocean bulk carrier total $1,125; for the Liberty vessel, $152, a difference of $973. The lake-ocean bulk carrier has a wheat cargo capacity 92 percent greater than the Liberty vessel. In addition, the costs for tug and pilot services, probably averaging $100 a day, are included in the daily cost figures for the lake-ocean bulk carrier and not included in daily Liberty vessel costs.

Tug and pilot service charges are shown in table 51. Except for the lake-ocean bulk carrier, where these expenses are included in the base daily operating cost figure, these have been added, as applicable, where other types of vessels were used in transporting grain. Wharfage and dockage costs, shown in table 59, also were included in the transportation cost analysis.

It has been assumed that income taxes do not constitute an operating cost but are represented in the profit allowance. Other taxes are regarded as a comparatively minor cost and have not been designated as a separate cost item in computing daily operating costs. An accurate estimate of miscellaneous taxes was impossible.

Another item that has not been included in the cost estimates is cargo insurance. This cost may vary from 1/2 to 1 cent a bushel. The exclusion of miscellaneous taxes and cargo insurance costs does not affect the comparative analysis, since these costs would apply regardless of vessel or port of origin.

Port costs at destination have not been included on movements overseas. However, for movements to United States destinations these costs are included (table 60). A St. Lawrence Seaway toll of 1-1/2 cents per bushel is included. Costs to overseas points are computed f.o.b. vessel at port of destination. Vessel charters usually specify delivery on this basis.

Table 61 includes examples of computed costs in cents per bushel and dollars per gross ton from U. S. ports to Rotterdam, Netherlands, for the movement of bulk wheat in a Liberty vessel and in the lake-ocean bulk carrier.

The distances used in these computations are from table 62. The following vessel speeds are used in computing times at sea: For the Liberty vessel, 11 knots in open water and 10 knots in restricted channels; for the lake-ocean bulk carrier, 13.5 knots in open water and 10 knots in restricted channels. For the transiting of the locks and the canals between Great Lakes ports and Montreal, the 1-way passage time is estimated as follows: From Duluth, 21 hours; from Chicago, 20-1/2 hours; from Toledo, 20-1/2 hours. To cover any unforeseen delays, an additional 24 hours is included in total voyage time at sea. From Great Lakes ports, in-port time per trip is estimated as 10 days for the Liberty vessel and 8 days for the lake-ocean bulk carrier, on the assumption that the latter vessel requires less time to load and discharge grain than the Liberty. This includes time for taking on fill-out cargo at Montreal. When shipments originate at deepwater ports of Baltimore or New Orleans, in-port time is reduced by 1 day. This is true also for the ports of New York, Montreal, and Seven Islands. All vessels moving beyond Montreal are assumed to be loaded to full draft. The fill-out cargo added at Montreal is assumed to move to that port in an "upper lakes" boat from the same upper-lake port, and the costs of this movement, computed on the round-trip basis, assuming the upper laker returns to the origin port without payload, are added to the total costs for the 1-way or round trip (table 61). In computing the 1-way costs, voyage costs for the 1-way trip are allocated to the 1-way grain cargo movement. In computing the voyage costs for the round trip, the voyage costs for the round trip are allocated to the one-way grain cargo movement.

Tables 63, 64 and 65 show the comparative estimated costs in cents per bushel for the movement of export wheat and soybeans, corn, and barley, respectively, between selected ports in a Liberty vessel and in the lake-ocean bulk carrier. The computed costs for corn and barley are based on the stowage required for these grains compared to that required for wheat and soybeans. Charges for trimming, wharfage, and tug service at origin and at the intermediate cargo fill-out port, Montreal, as applicable, are included.

In tables 66 and 67, transportation costs are shown for a Liberty vessel and the lake-ocean bulk carrier for direct movements overseas from U. S. Great Lakes ports, as compared to movements by upper laker to Montreal and Seven Islands and movement in oceangoing vessels beyond to foreign ports. These are computed on both the one-way and the round-trip basis. The computations indicate that the direct shipments in oceangoing vessels, filling out with cargo at Montreal, cost several cents per bushel less than the combination shipments, by laker to Montreal or Seven Islands, and by oceangoing vessel beyond. This is attributable to the higher transportation costs in the upper lakers as compared to the oceangoing vessels, and to the added handling of a greater volume of grain at lower St. Lawrence ports when the ocean vessels pick up their full cargoes. In these one-way cost analyses, it was assumed that the laker vessels had return payload cargoes from Montreal or Seven Islands to upper-lake ports.

Table 68 gives cost computation examples for movements from selected ports on the Great Lakes and from New Orleans to Baltimore, Md. Estimated cost data for domestic grain movements by water to other Atlantic coast ports are presented in tables 69, 70,

and 71, for wheat and soybeans, corn, and barley, respectively. The costs are computed f.o.b. vessel at port of destination. Inbound grain handling charges at Atlantic Coast ports are given in table 27. Other charges at these ports, including those for pilotage, tug service, wharfage, and stevedoring, are shown in table 60.

Table 72 provides information on average transportation rates for heavy grains (wheat, corn, soybeans) between selected world port areas for the period August through November 1957. During this period, rates charged for moving grain to foreign ports were depressed, as available cargo space far exceeded the demand for transportation. The extent of this is apparent when computed costs (table 63) are compared with the rates shown in table 72. The 1-way transportation costs for wheat, including a profit margin, in a Liberty vessel, between Montreal and Rotterdam, are shown as 13.28 cents per bushel. The comparable charge was 13.50 cents per bushel. For other movements, computed costs, including profit, exceeded the rates charged, bearing out the contention of ship owners that rates were depressed below minimum costs. From the Gulf of Mexico to Rotterdam, costs are estimated at 16.68 cents per bushel; charges were 16.00 cents per bushel; from Baltimore to Rotterdam, costs are computed as 13.72 cents per bushel, charges 13.70 cents; from the U. S. Pacific Coast to Rotterdam, costs 24.01 cents per bushel, charges 17.70 cents.

Table 73, showing freight rates for cargoes of heavy grain, 1953 through May 1957, reveals the wide variation in the level of rates prevailing between given areas, annually and monthly. Ocean shipping rates were relatively high in 1955 and 1956, when large volumes of grain were moving in international commerce. The rates shown in table 72, August through November 1957, approach the low levels of 1953 and 1954, as shown in table 73.

Table 74 shows freight rate differences for cargoes of heavy grain moving from the U. S. Atlantic, Gulf, and Pacific Coasts to world port areas, as compared to similar movements from the St. Lawrence, 1953-1956. To the Antwerp-Hamburg area, average rates from the U. S. Atlantic and Gulf port areas have been consistently higher than from the St. Lawrence ports. However, the difference between the U. S. Atlantic and the St. Lawrence averages, 1953 through 1955, was less than 1 cent a bushel, whereas the differences between the U. S. Gulf and the St. Lawrence averages ranged from 1.8 cents per bushel in 1953 to 4.9 cents in 1955.

The fact that ocean shipping rates show wide variations over relatively short periods of time is the basis for using rates prevailing during a limited time period in 1957. The fact that rates were severely depressed during this period also is an advantage, as indicated above, since these rates lend themselves to a more meaningful comparison with estimated costs.

The ocean rates effective August through November 1957 were incorporated in the charge analysis to points overseas, although charges by other modes of transport, as well as the computed costs, were those applicable as of July 15, 1957. The computed transportation costs and charges, including applicable handling expenses, are summarized in three sets of tabulations.

Interior Points to Ports.--Tables 75, 76, 77, and 78 indicate, for shipments of wheat, corn, barley, and soybeans, respectively, the lowest total computed costs and the lowest total charges, in cents per bushel, between interior origins and ports of export. The specific mode or modes of transportation and the routings are identified. The costs and charges are computed on an f.o.b. vessel basis at the port of export. Handling expenses are included and separately identified. These cover handling at origin, at intermediate grain transfer points as applicable, and at the port of export.

Through Costs and Charges from Interior Points to Foreign Ports.--Tables 79, 80, 81, and 82 show, for wheat, corn, barley, and soybeans, respectively, the lowest total computed costs and the lowest total charges, in cents per bushel, between Great Lakes and interior origins and foreign ports of destination. The comparative costs and charges

are for both the Liberty-type and the lake-ocean bulk carrier vessels, and they indicate the one-way and the round-trip costs. Costs and charges are from origin to f.o.b. vessel at port of destination. To the data given in tables 75, 76, 77, and 78, referred to previously, were added the applicable costs and charges from the selected port of export, as shown in tables 63, 64, and 65. Charges included in table 72, applicable to heavy grain, were assumed to apply to the 4 grains covered by this study. Handling expenses are included, but are not identified separately in this second set of tabulations.

Through Costs and Charges from Interior Points to Atlantic Coast Domestic Markets.--Tables 83, 84, 85, 86, and 87 indicate the computed costs and charges for shipments to specified Atlantic Coast points of destination by the several competitive routings, for wheat, corn, barley, and soybean movements from the Great Lakes ports and other selected origins. The charges and costs include, in addition to transportation, any applicable grain handling at transfer points. They do not include handling expenses at origin. For routings involving shipment by Liberty vessel or lake-ocean bulk carrier, only costs are included, since there are no existing grain movements by these vessels between the selected origins and destinations on which to base data on charges. The costs are indicated for both the one-way and the round trip movements.

SUMMARY OF COMPUTED COSTS AND CHARGES ON GRAIN FROM INTERIOR POINTS TO FOREIGN PORTS

Foreign destinations were selected on the basis of geographical considerations (fig. 28) and reflect movements of export grain for which the St. Lawrence Seaway represents a potential gateway. Rotterdam, Netherlands, was selected as the northern European port, because from this port there extends a vast system of inland waterways serving many nations of western Europe (fig. 24). Actually, most grain unloaded at Antwerp or Rotterdam is transferred to barges for movement inland. Rotterdam is regarded as a representative geographical location for movements of grain to northern and western Europe.[5]

Casablanca, Morocco, while not a large receiving port for grain, was selected because it is close to the Mediterranean Sea gateway at the Straits of Gibraltar. A comparison of the level of transportation costs by various routings to Casablanca identifies any potential economy of the Great Lakes-St. Lawrence waterway in serving not only Casablanca and much of western Africa, but the Mediterranean region and areas east as far as the west coast of India, including the countries of eastern Africa.

Santos, Brazil, just south of Rio de Janeiro, was selected as the third foreign port of destination because of its central location on the east coast of South America.

The transportation cost analysis includes the computed costs to the carriers of moving grain from the production areas to the export destinations via the numerous selected routings. In addition, since grain handling expenses vary at the many points where grain is transferred from one carrier to another, and since they are a major part of the total expenses for getting grain from origin to destination, they are added to the transportation costs. Computed costs and charges for the various routings, therefore, reflect actual transportation plus handling of the grain.

These costs are compared with each other to ascertain the lowest cost routings. They also are compared with known charges via existing routings, and thus given an indication of the actual economy for any of the specific grain movements included in the study, as well as an indication of how much charges for shipments by some routings might be reduced to meet the competition of new routings.

Figures 29 and 30 present graphically the economy of various export routes for the movement of wheat, corn, barley, and soybeans from 22 U. S. origins in 13 States to the

[5] The illustrations of computed transportation costs and charges used in the text relate to the movement of wheat. For specific costs and charges for transporting corn, barley, and soybeans, consult the applicable tables.

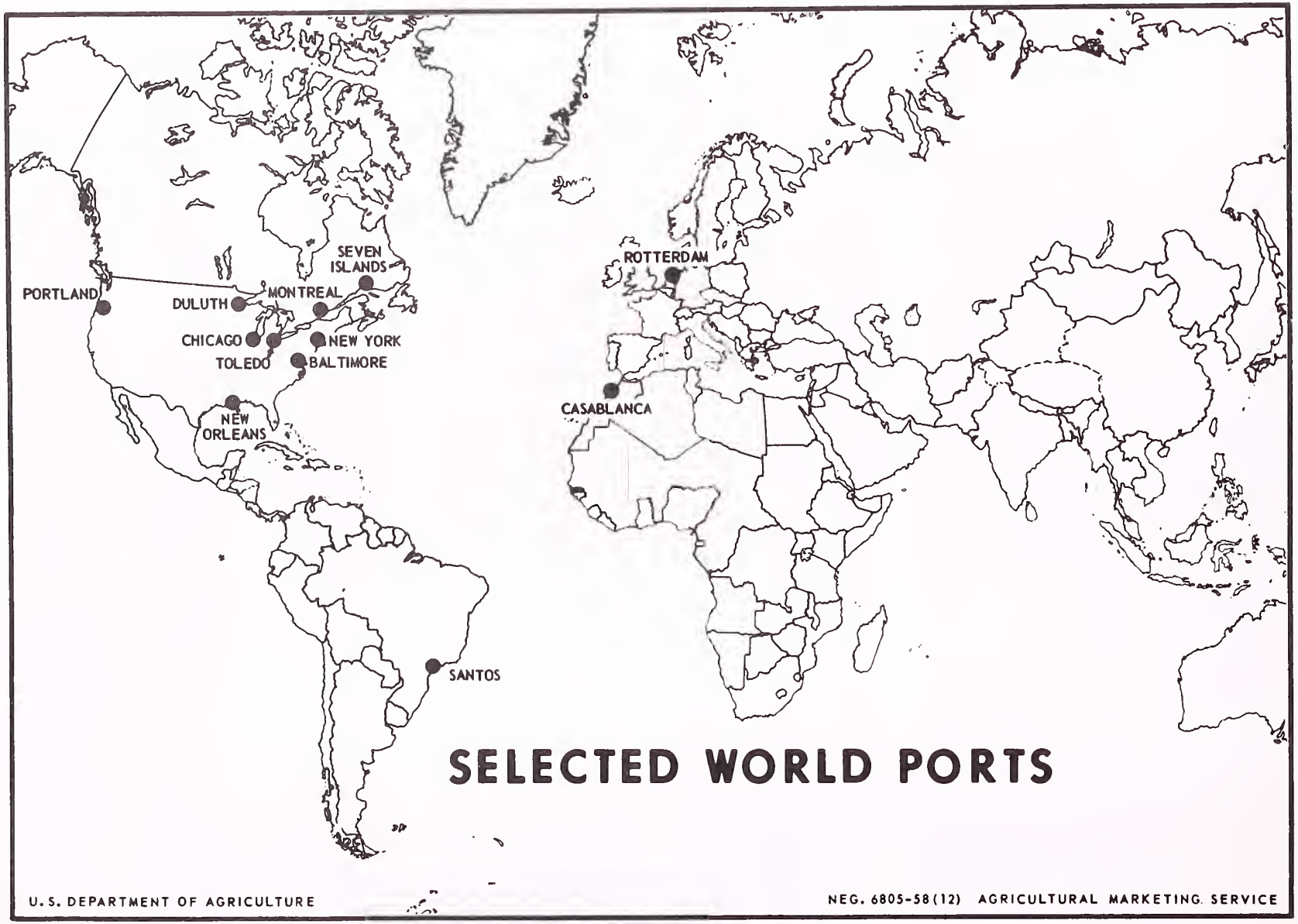

SEVEN ISLANDS
ROTTERDAM
PORTLAND
DULUTH
MONTREAL
CHICAGO
NEW YORK
TOLEDO
BALTIMORE
CASABLANCA
NEW ORLEANS
SANTOS
SELECTED WORLD PORTS
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Figure 28.

3 selected foreign destinations, using a Liberty vessel for the overseas transportation, and assuming the vessel has a return payload. These graphic presentations are based on computed costs and actual charges, in each case by the route having the lowest cost or lowest charge, effective in 1957. The costs are the computed costs to the carrier or carriers plus handling. The charges are the transportation rates and handling expenses the shipper pays. For the railroad transportation, computed out-of-pocket costs are used (pp. 26-29). The costs for other carriers also include a profit margin above other cost factors. Computed out-of-pocket rail costs were used on the assumption that much of the St. Lawrence Seaway grain traffic may constitute a diversion from existing routes, which, for the most part, include rail transportation. It is assumed that the Interstate Commerce Commission will not sanction railroad rates below out-of-pocket costs. Therefore, the comparative computed costs by the various routes between production areas and destinations include rail costs on an out-of-pocket basis as defined by the Interstate Commerce Commission. Use of fully distributed railroad costs would not reflect the minimum level of charges that might be permitted. The four routings are as follows: Via Montreal on the Great Lakes-St. Lawrence waterway; via New Orleans, via Baltimore or New York City, and via Portland, Oreg.

To Rotterdam, Netherlands, total computed costs for the movement of wheat via the Seaway route are less than, or about the same as, the computed costs via present routes from the following selected interior origins: Columbus, Ohio; Indianapolis, Ind.; Decatur, Ill.; St. Louis, Mo.; Wichita, Kans.; Garden City, Kans.; Limon, Colo.; and Shelby, Mont. Other origins closer to the Great Lakes within this group are: Minot, N. Dak.; Mankato, Minn.; Minneapolis, Minn.; Omaha, Nebr., Kearney, Nebr.; and Fort Dodge, Iowa.

The following selected origins have lower cost outlets via New Orleans, which for the most part, can be attributed to the low costs of barge transportation on the inland waterways: Cincinnati, Ohio; Evansville, Ind.; and Memphis, Tenn. The cost of moving grain by rail from Enid, Okla. to New Orleans is less than the cost by any routing to the Great Lakes. It is apparent that for movements to Rotterdam from the selected origins, Baltimore or New York City are not competitive on a cost basis, although out-of-pocket railroad costs are used in the cost analysis.

The analysis of charges to Rotterdam indicates the importance of New Orleans as a port of export. On this basis, North Atlantic ports are competitive only from Columbus, Ohio; Decautr, Ill.; and Indianapolis, Ind. Portland, Oreg., is competitive for movements from Shelby, Mont.

To the extent that charges gravitate to the computed cost level, the analysis indicates that grain movements to the port of Rotterdam and its tributary area, from areas represented by many of the selected origins, would be routed during the open navigation season by the Great Lakes-St. Lawrence waterway. Both the Gulf and the North Atlantic ports face significant competition from ports on the Great Lakes.

To Casablanca, Morocco, routings from the Great Lakes ports are more circuitous, but, except from St. Louis, Mo., the results are almost the same. From St. Louis, the low-cost and low-charge routing is through the port of New Orleans. It includes barge transportation to New Orleans with transshipment on overseas.

To Santos, Brazil, routing through the Great Lakes-St. Lawrence waterway is circuitous compared to that from North Atlantic or Gulf ports. The computed costs for the Great Lakes-Seaway route are less than or about the same as computed costs on other routings from the following selected interior origins: Columbus, Ohio; Indianapolis, Ind.; Decatur, Ill.; Fort Dodge, Iowa; Mankato, Minn.; Minot, N. Dak.; and Shelby, Mont. All other origins have lower cost routings through New Orleans.

The analysis of charges to Santos indicates the importance of New Orleans as a port of export. In this trade, North Atlantic ports are competitive with New Orleans only from Columbus, Ohio; Indianapolis, Ind., and Decatur, Ill. To Santos, on both a computed cost

MOST ECONOMICAL ROUTES FOR GRAIN EXPORTS

Based on Charges From Selected Origins, 1957

EXPORT GATEWAYS: X= GREAT LAKES - ST. LAWRENCE; ●= NEW ORLEANS; □= BALTIMORE AND/OR NEW YORK; ▲= PORTLAND, OREGON

ORIGIN	TO ROTTERDAM, NETHERLANDS				TO CASABLANCA, MOROCCO				TO SANTOS, BRAZIL			
	WHEAT	CORN	BARLEY	SOYBEANS	WHEAT	CORN	BARLEY	SOYBEANS	WHEAT	CORN	BARLEY	SOYBEANS
Chicago, Ill.	X	X	X	X	X	X	X	X	X□	X□	X□	X□
Cincinnati, Ohio	●	●	●	●	●	●	●	●	●	●	●	●
Columbus, Ohio	X	X	□	X	X	X	X□	X	X	X□	□	X
Decatur, Ill.	□●	□	□	●	□	□	□	X●	□●	□●	□●	●
Duluth, Minn.	X	X	X	X	X	X	X	X	X□	X□	X□	X□
Enid, Okla.	●	●	●	●	●	●	●	●	●	●	●	●
Evansville, Ind.	●	●	●	●	●	●	●	●	●	●	●	●
Fort Dodge, Iowa	●	●	●	●	●	●	●	●	●	●	●	●
Garden City, Kans.	●	●	●	●	●	●	●	●	●	●	●	●
Indianapolis, Ind.	X□	□	□	□	X	X□	□	X	□	□	□	X□
Kansas City, Mo.	●	●	●	●	●	●	●	●	●	●	●	●
Kearney, Nebr.	●	●	●	●	●	●	●	●	●	●	●	●
Limon, Colo.	●	●	●	–	●	●	●	–	●	●	●	–
Mankato, Minn.	●	●	●	●	X●	●	●	X●	●	●	●	●
Memphis, Tenn.	●	●	●	●	●	●	●	●	●	●	●	●
Minneapolis, Minn.	●	●	●	●	X●	●	●	X●	●	●	●	●
Minot, N. Dak.	X	X	X●	X	X	X	X	X	X●	X●	●	X●
Omaha, Nebr.	●	●	●	●	●	●	●	●	●	●	●	●
Shelby, Mont.	▲	–	▲	–	▲	–	▲	–	▲	–	▲	–
St. Louis, Mo.	●	●	●	●	●	●	●	●	●	●	●	●
Toledo, Ohio	X	X	X	X	X	X	X	X	X	X	X	X
Wichita, Kans.	●	●	●	●	●	●	●	●	●	●	●	●

SHIPMENTS ARE BY BARGE, TRUCK, OR RAIL TO EXPORT GATEWAYS, AND BY OCEAN-GOING VESSEL TO FOREIGN DESTINATION.

WHEN MORE THAN ONE SYMBOL APPEARS IN BOX, THE CHARGES BY ROUTINGS INDICATED DIFFER BY NOT MORE THAN 1½ CENTS PER BUSHEL, SHOWING SUBSTANTIAL EQUALITY.

CHARGES ARE FOR ONE-WAY TRANSPORTATION ONLY.

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Figure 29.

MOST ECONOMICAL ROUTES FOR GRAIN EXPORTS

Based on Costs From Selected Origins, 1957

EXPORT GATEWAYS: X= GREAT LAKES - ST. LAWRENCE; ●= NEW ORLEANS; □= BALTIMORE AND/OR NEW YORK; ▲= PORTLAND, OREGON

ORIGIN	TO ROTTERDAM, NETHERLANDS				TO CASABLANCA, MOROCCO				TO SANTOS, BRAZIL			
	WHEAT	CORN	BARLEY	SOYBEANS	WHEAT	CORN	BARLEY	SOYBEANS	WHEAT	CORN	BARLEY	SOYBEANS
Chicago, Ill.	X	X	X	X	X	X	X	X	X	X	X	X
Cincinnati, Ohio	●	●	X●	●	●	●	●	●	●	●	●	●
Columbus, Ohio	X	X	X□	X	X	X□	X□	X	X□	X□	□	X□
Decatur, Ill.	X	X	X	X	X	X	X	X	X●	X●	X□●	X●
Duluth, Minn.	X	X	X	X	X	X	X	X	X	X	X	X
Enid, Okla.	●	●	●	●	●	●	●	●	●	●	●	●
Evansville, Ind.	●	●	●	●	●	●	●	●	●	●	●	●
Fort Dodge, Iowa	X	X	X	X	X	X	X	X	X	X	X□	X
Garden City, Kans.	X●	X●	●	X●	X●	●	●	X●	●	●	●	●
Indianapolis, Ind.	X	X	X	X	X	X	X□	X	X	X□	X□	X
Kansas City, Mo.	X●	X●	X●	X●	X●	X●	●	X●	●	●	●	●
Kearney, Nebr.	X●	X●	X	X●	X●	X●	X●	X●	●	●	●	●
Limon, Colo.	X●	X●	X●	–	X●	X●	X●	–	●	●	●	–
Mankato, Minn.	X	X	X	X	X	X	X	X	X	X	X	X
Memphis, Tenn.	●	●	●	●	●	●	●	●	●	●	●	●
Minneapolis, Minn.	X●	X●	X●	X●	X●	X●	X●	X●	●	●	●	●
Minot, N. Dak.	X	X	X	X	X	X	X	X	X	X	X□	X
Omaha, Nebr.	X●	X●	X●	X●	X●	X●	●	X●	●	●	●	●
Shelby, Mont.	X	–	X	–	X	–	X	–	X▲	–	X▲	–
St. Louis, Mo.	X●	X●	X●	X●	●	●	●	●	●	●	●	●
Toledo, Ohio	X	X	X	X	X	X	X	X	X	X	X	X
Wichita, Kans.	X●	X●	X●	X●	X●	X●	X●	X●	●	●	●	●

SHIPMENTS ARE BY BARGE, TRUCK, OR RAIL TO EXPORT GATEWAYS, AND BY LIBERTY-TYPE VESSEL TO FOREIGN DESTINATION.

WHEN MORE THAN ONE SYMBOL APPEARS IN BOX, THE COSTS BY ROUTINGS INDICATED DIFFER BY NOT MORE THAN 1½ CENTS PER BUSHEL, SHOWING SUBSTANTIAL EQUALITY.

COSTS BASED ON ONE-WAY TRIP, ASSUMING VESSEL HAS RETURN PAYLOAD OR DOES NOT RETURN TO PORT OF ORIGIN.

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Figure 30.

and charge basis, Portland, Oreg., is competitive as a port of export from Shelby, Mont. While it should not be assumed that computed costs, as of July 1957, for the transportation and handling of wheat reflect the actual level of charges via the completed St. Lawrence Seaway, it is assumed that this level of charges falls within the range between computed costs and actual transportation and handling charges for movements between any given origin and destination. In the absence of any regulation of grain transportation charges, as is the case from Great Lakes ports to foreign destinations, this assumption is particularly valid.

The computed cost of moving wheat by the Seaway from Duluth to Rotterdam in a Liberty vessel (table 79) is 21.43 cents per bushel, assuming that the vessel has a return payload cargo. The lowest charge from Duluth to Rotterdam before opening of the Seaway was 35.30 cents per bushel, or a maximum differential of 13.87 cents per bushel. If it were assumed that the Liberty vessel returned empty and the round-trip expenses were borne entirely by the 1-way grain cargo, the computed cost per bushel would be 27.63 cents. This is 7.67 cents per bushel less than the lowest charge of 35.30 cents per bushel. Therefore, the differential between the computed costs via the Seaway, using a Liberty vessel, and the pre-seaway charge, ranges from 7.67 to 13.87 cents per bushel. The level of costs is lower for the lake-ocean bulk carrier, for which the differential ranges from 11.56 to 17.23 cents per bushel.

On shipments from Duluth to Casablanca, in a Liberty vessel, the differential between computed costs on the Seaway route and actual pre-Seaway charges ranges from 7.76 to 14.32 cents per bushel. In the lake-ocean bulk carrier, the range is from 11.77 to 17.74 cents per bushel. To Santos, the differential for a Liberty vessel ranges from 5.48 to 16.17 cents per bushel; for a lake-ocean bulk carrier, from 11.03 to 20.31 cents per bushel.

In these comparisons, the lowest charge routing is for vessels plying from Duluth down the Great Lakes and through the 14-foot St. Lawrence canals. The analysis assumes a transshipment between "upper lakes" and canaller types of vessels. Actually, very little U. S. grain moved by this all-water routing. The charges are higher on the routings that usually have been used; that is, ex-lake to New York City or to Baltimore, for overseas movement beyond. Therefore, the differentials between computed costs and actual charges are considerably less than those that would result if the comparison were with charges on the actual U. S. export grain routings. For example, the total charges for wheat moved to Rotterdam from Duluth by laker to Buffalo, thence by rail to New York City, and from there in an oceangoing vessel, including all handling, are 3.58 cents per bushel above the pre-Seaway all-water charge direct from Duluth to Rotterdam. Adding this to the Liberty vessel differential given above results in a range of 11.25 to 17.45 cents per bushel. This may be a more accurate indication of the effect of the completed Great Lakes-St. Lawrence waterway on the cost of transporting wheat from Duluth to Rotterdam.

The differentials between computed costs and charges from Chicago to the 3 foreign ports are slightly greater than from Duluth. The difference is less than 1 cent a bushel.

From Toledo to Rotterdam, the differentials are somewhat less. Computed costs using the Seaway, including handling, for the transportation of wheat in a Liberty vessel, assuming the vessel has a return payload, are 19.59 cents a bushel and without return payload, 24.53 cents. The lowest total charge was by the direct all-water route from Toledo using the old Great Lakes-St. Lawrence channels, canals, and locks. This charge was 29.03 cents per bushel. The differential between computed costs and charges ranges from 4.50 to 9.44 cents per bushel. Using the lake-ocean bulk carrier, the differential range is 8.24 to 12.90 cents per bushel. Comparison of computed costs by the modernized Great Lakes-St. Lawrence route with charges by the export channel through New York City results in differentials for movement in a Liberty vessel ranging from 10.35 to 15.29 cents per bushel, and for movement in the lake-ocean bulk carrier, from 14.09 to 18.75 cents per bushel.

From Toledo to Casablanca, the differential range between the computed cost in a Liberty vessel via the Seaway and the charges before opening of the Seaway is from 4.59 to 9.89 cents per bushel; in a lake-ocean bulk carrier, 8.47 to 13.42 cents per bushel. Each of these comparisons reflects the low all-water charges via the old Great Lakes-St. Lawrence channels, locks, and canals. Charges have been 8.15 cents per bushel greater ex-lake to New York and export beyond, increasing the differential range from 12.74 to 18.04 cents per bushel for movement in a Liberty vessel, and from 16.62 to 21.57 cents per bushel for movement in the lake-ocean bulk carrier.

From Toledo to Santos, estimated costs 1-way by Liberty vessel total 23.99 cents per bushel. The round-trip costs total 33.33 cents. The charges for all-water movement via the old Great Lakes-St. Lawrence channels, locks, and canals have been 35.63 cents per bushel, but charges over the ex-lake routing via New York City totalled 39.38 cents. The differentials range from 2.30 to 11.64 cents and from 6.05 to 15.39 cents, depending on the routing used in the comparison. Using the lower cost lake-ocean bulk carrier, the differential ranges are 7.73 to 15.99 and 11.48 to 19.74 cents per bushel.

Figure 31 indicates the U. S. wheat production area that could use the Great Lakes route on the basis of charges to shippers, assuming the grain moved from the Great Lakes ports via upper laker and was transshipped at lower-lake ports to small oceangoing vessels for passage through the 14-foot St. Lawrence Canals and on overseas to Rotterdam. Also indicated is the expanded area that can economically use the Great Lakes-St. Lawrence waterway with completed navigation improvements. The delineation of this area is on the basis of one-way carrier costs for overseas movement of wheat in a Liberty vessel. The principal competitive factor in determining the extent of the area that could economically use the Great Lakes-St. Lawrence waterway is low-cost barge transportation to New Orleans via the interconnected inland waterways. The boundary line,

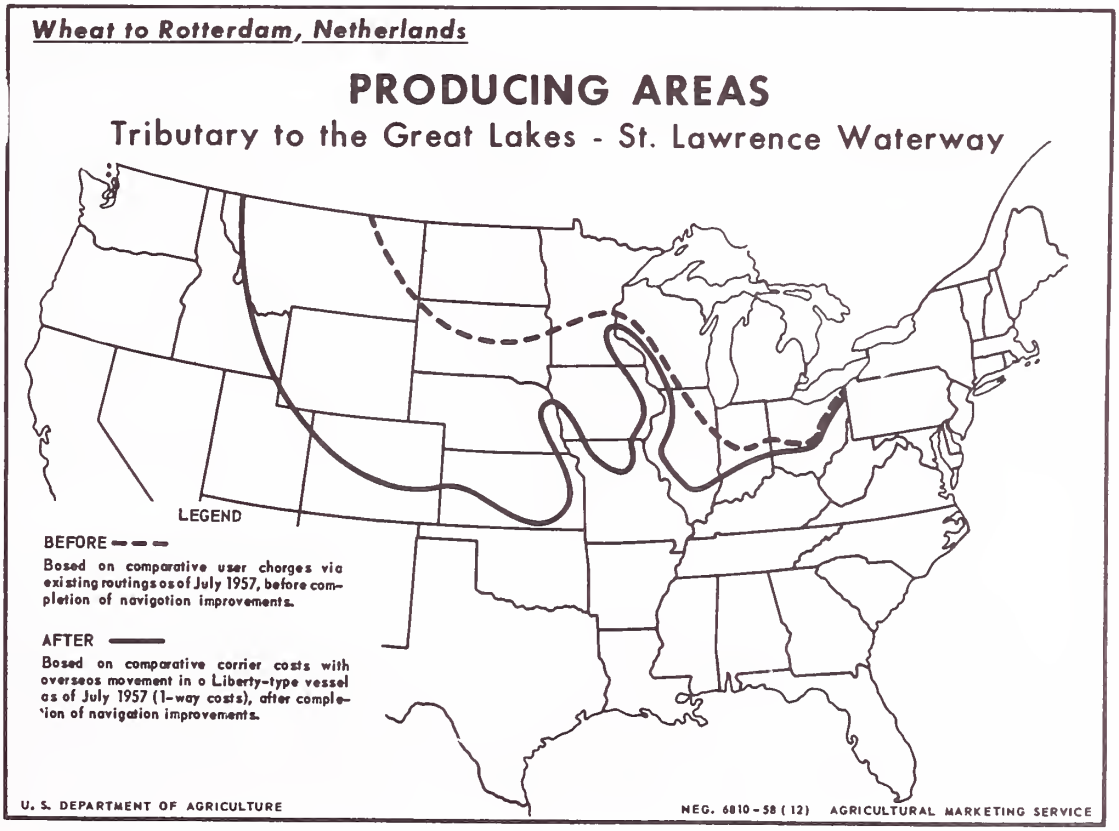
Wheat to Rotterdam, Netherlands
PRODUCING AREAS
Tributary to the Great Lakes - St. Lawrence Waterway
LEGEND
BEFORE
Based on comparative user charges via existing routings as of July 1957, before completion of navigation improvements.
AFTER
Based on comparative carrier costs with overseas movement in a Liberty-type vessel as of July 1957 (1-way costs), after completion of navigation improvements.
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Figure 31.

assuming overseas movement in a Liberty vessel, follows the Missouri, upper Mississippi, and Ohio Rivers. The line would be similarly located for other grains, but the area that can economically use the Lakes-Seaway route is somewhat smaller to Casablanca, Morocco, and much more restricted to Santos, Brazil, because of greater circuity of routings.

Another comparison of significance is the relationship of costs via one routing with costs via competitive routings. For example, for direct shipment through the Seaway of wheat from the port of Duluth in a Liberty vessel to Rotterdam, assuming the Liberty vessel has a return payload, the computed costs of transportation and handling total 21.43 cents per bushel. For the ex-lake movement into Baltimore with ocean transportation beyond, the costs total 33.24 cents per bushel. This latter cost is based on movement by laker to Buffalo and by rail to Baltimore. Costs for the rail portion of the haul are the computed out-of-pocket costs, and are assumed to be the minimum charges that would be permitted by the Interstate Commerce Commission. The July 1957 charge for this shipment, including handling, was 40.37 cents per bushel. Should the railroad rate be at the level of out-of-pocket costs, it would be reduced 3.47 cents per bushel (table 35). This, in turn, would reduce the through charges to 36.90 cents per bushel between Duluth and Rotterdam via Baltimore, still substantially above the 21.43 cents per bushel cost via the Seaway, allocating only the 1-way vessel expenses to the 1-way cargo movement. Also, the 36.90-cent figure is substantially in excess of 27.63 cents per bushel, the cost which results when it is assumed the Liberty vessel's round-trip expenses are charged to the 1-way grain payload. Actual rates for Great Lakes-St. Lawrence ocean movement may be higher than the 21.43 or 27.63 cents per bushel, but there is every reason to believe they will not reach the 36.90 cents per bushel charge via combination laker-rail-ocean vessel routing, that assumes rail rates depressed to the computed out-of-pocket cost level. Similar comparisons can be made for other routings involving rail hauls.

Perhaps some indication of the importance of the modernized Great Lakes-St. Lawrence waterway to competing grain markets also can be derived from a comparison of transportation costs. Referring again to table 79, and considering total transportation and handling charges and costs from 2 of the grain markets--Duluth and Minneapolis--the charges for moving wheat to Rotterdam are about the same from Duluth through New York City and from Minneapolis through New Orleans, 38.88 and 38.20 cents per bushel, respectively. However, Liberty vessel 1-way costs from the ports of export differ, New Orleans having an advantage of about 5 cents a bushel, the difference between 30.11 and 35.03 cents per bushel. But the computed direct 1-way costs for movement in a Liberty vessel from Duluth via the modernized Seaway total 21.43 cents per bushel, or 8.57 cents per bushel less than the combination barge-Liberty vessel costs via New Orleans. Allocating the round-trip vessel expenses to the 1-way grain shipment in the Liberty vessel from Duluth to Rotterdam, the cost is 27.63 cents per bushel, or 2.48 cents per bushel less than the 1-way expense allocation (30.11 cents) via New Orleans. In this instance, should the cost structure reflect future charges, grain that formerly moved from Minneapolis to New Orleans by barge for export to Rotterdam could be shipped more economically direct from Duluth to Rotterdam, assuming an equality of all other influencing factors.

On the basis of the transportation charge and cost analysis, Chicago and Toledo will be strongly competitive in the movement of export grain. Total transportation and handling charges for moving corn from Decatur, Ill., to Rotterdam are about equal via New Orleans, New York City, and Baltimore, with the latter having a slight competitive advantage (table 80). Rail-ocean charges through Baltimore total 37.07 cents per bushel; through Toledo on the truck-water routing via the unimproved Great Lakes-St. Lawrence route, total charges have been 46.56 cents per bushel (table 80); and via Chicago, the charge via truck-water routing has been 49.75 cents per bushel. It is apparent that neither Chicago nor Toledo has been competitive with the other ports of export, New Orleans, New York City, or Baltimore.

The one-way Liberty vessel costs, using the modernized Seaway, give Chicago and Toledo the cost advantage over the other ports of export. On this 1-way basis, the computed cost is 32.14 cents per bushel via truck routing from Decatur to Chicago, and 32.75 cents via truck routing to Toledo, using a Liberty vessel beyond to Rotterdam. Assuming that the Liberty vessel returns without payload and the one-way corn cargo bears the round-trip vessel expenses, round-trip costs are about equal on movements from Decatur via either Chicago or Toledo. It appears that the actual routing would depend in large part on import traffic movements through these ports or other ports in close proximity. Should return cargo be available in greater volume to Lake Erie ports than to ports on Lake Michigan, grain rates from Toledo possibly would be lower than those from Chicago. Should the contrary be true, Chicago would have the advantage in grain shipments. A glance at Indianapolis as an origin indicates a similar situation.

In summary, the analysis of comparative transportation costs by all competitive routings indicates the basic economy of the Great Lakes-Seaway-ocean route for export grain movements. Parts or all of 17 grain-producing States make up the tributary area. To the extent that charges for grain transportation to the ports of export gravitate toward the level of computed transportation costs, the greater will be the grain-producing area that will benefit by transportation savings via the St. Lawrence Seaway for export movements.

The transportation of grain to foreign markets from a broad hinterland area in the Midwestern States by the Great Lakes-St. Lawrence waterway will be the most economical export route, either with overseas movement in a Liberty vessel, purchased at low war-surplus-disposal prices, or in a modern lake-ocean bulk carrier, purchased at current prices.

SUMMARY OF COMPUTED COSTS AND CHARGES ON GRAIN TO ATLANTIC COAST PORTS AND TRIBUTARY AREAS

A previous section of this report noted the concentration of grain production in the Midwest. Generally speaking, animal feeding is concentrated in the Midwest, as is grain milling capacity, although there has been a trend toward the dispersion of feed mills to locations in important consuming areas, such as the Delaware-Maryland-Virginia peninsula and heavy broiler-producing areas in the Southern States. Buffalo also is important as a feed and flour milling center because of its location at the lower end of Lake Erie, making it tributary to a large area of consumption of those products. The by-products of flour milling, the brans and middlings, are used in animal feeds.

The grains in their raw form are heavier per unit of volume than the milled products, and this explains in part the concentration of milling capacity close to the animal feeding areas. The heavier grains move to the nearby mills and the lighter flours and feeds move to consuming areas. Although the greater volume of feeds is consumed in the midwestern feeding area, considerable amounts move to other areas where the volume fed is less but where the dairy and poultry industries are important. The flour moves to human population concentration points, including the large cities along the Atlantic Coast. Mills in New England and Atlantic Coast States procure some of their raw grain from nearby producing areas, but they bring in substantial volumes from the Midwest (see pp. 6-9). The flour and feed produced by these mills compete with those from the Midwest for the eastern and southeastern markets.

Rail transportation charges are established at levels to accommodate the geographical patterns of grain production, animal feeding, and human population concentration. The rail rate structure includes milling-in-transit privileges (29). These privileges permit the movement of grain to a milling point where it is processed, and the movement of the flour, feed, and other products on to final destination at a rate calculated from the point of origin of the grain. The "transit balance" depends on the rate into the milling point, and is the difference between the through rate from origin to destination and the rate from origin to the milling point.

These transit balances generally are lower than the applicable proportional rail rates on grain that are used in this study. (The proportional rate is a reshipping rate that is published specifically for use only as a factor in determining a combination through rate. It can be proportional either on the origin or destination ends, or on both). Proportional rates are effective from most of the larger grain markets. Where they are not available, the through rate with transit privileges applies.

Transit balances from a specific market or milling point to a given destination vary, sometimes widely, according to the origin of the inbound grain billing submitted in support of the outbound movement. This phase of the study does not assume the use of any particular mode of transport into the selected shipping markets, nor are specific production areas assumed. For example, rates based upon transit balances may apply from Chicago to points in the Atlantic area, but the level of these balance rates would depend not only upon the destination, but also upon the point where the grain originated and the mode of transportation into these markets. Inbound grain by truck would not be entitled to transit privileges.

It is not practicable to estimate what the transit balances might be from such points as Chicago, Toledo, or Buffalo to Atlantic Coast ports or points in the interior on the route to those ports. Consequently, the use of proportional rail rates has been adopted as the only feasible procedure, although it is recognized that the use of rail charges based upon proportional rates may result in overstatement of the rail charges by as much as 5 cents per bushel.

Many of the eastern and southeastern mills are inland from the Atlantic coastal ports, close to animal concentration areas. Feed and flour milling capacity at or near the major Atlantic Coast ports is small compared to the capacity at Buffalo and in the North Central States. There are a few sizable feed mills at Baltimore, Norfolk, and Carolina ports, but investigation does not develop that any of these is situated on deep water that would accommodate oceangoing vessels. Accordingly, extra charges would be involved for the transfer of grain from deepwater elevators to mills at these ports. To inland mills, the operation would involve unloading at elevators on deep water and loading out by rail or truck to an interior mill, charges that would not be made against direct shipments by rail, motortruck, or a combination of water-rail or water-truck routes from Midwestern markets. The extra charges for transfer at the ports (not including the charges for further movement to interior mills) are estimated at 5.52 cents per bushel (table 27).

Tables 83 through 87 compare the out-of-pocket costs via the Seaway with the charges and out-of-pocket costs via alternative inland routes from representative Midwestern markets from which grains could be expected to move to the ports of Boston, New York, Baltimore, Wilmington, and Savannah. They show that charges via these inland routes are somewhat higher than the potential costs of movement via the Seaway, but they also show that the latter are higher than the out-of-pocket costs over one or more inland routes in each instance. This means that, while there may be some economy in moving grain through the Seaway if the charges are based upon the computed costs compared to the charges via inland routes, when the rates from the ports to interior mills are added, the area that can be reached through the ports at charges less than those of the inland routes is limited.

Further, the tables show that, should such movements develop, the inland carriers would be able to reduce their rates to meet the Seaway competition and still have a fair margin above out-of-pocket costs.

This would also be true at the ports themselves as long as the applicable transfer charges from the deepwater elevator to mill had to be borne in connection with the Seaway route. These transfer charges could be eliminated by the construction of new mills on deepwater sites or by deepening channels to those elevators now located on water too shallow to accommodate a Liberty or lake-ocean bulk carrier. This would not appear to be an attractive alternative.

It appears, on the basis of actual transportation costs, that there is little, if any, potential for the economical use of the Seaway route on shipments of grain from lake ports to ports on the Atlantic Coast within the foreseeable future.

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APPENDIX

TABLE 1.--Grain production in selected states, average 1945-54; annual 1955 and 1956

Area and period	Wheat	Corn	Barley	Soybeans	Oats	Sorghum grain	Flaxseed	Rye	Total
Colorado:	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels
1945-54 average	42,984	13,328	13,368	---	5,563	2,816	---	341	78,400
1955	17,712	17,064	8,294	---	3,906	4,950	---	196	52,122
1956	18,842	17,952	7,752	---	3,717	2,852	---	126	51,241
Illinois:									
1945-54 average	36,561	467,584	1,002	83,096	141,595	---	---	759	730,617
1955	52,008	513,576	5,270	99,544	177,408	---	---	1,836	849,642
1956	59,496	598,672	4,176	134,948	142,927	---	---	1,444	941,663
Indiana:									
1945-54 average	35,555	234,929	762	34,809	48,645	45	---	946	355,691
1955	34,394	276,136	2,958	43,838	66,402	66	---	1,700	425,494
1956	35,580	296,546	2,890	52,128	56,250	80	---	1,260	444,734
Iowa:									
1945-54 average	4,041	539,996	682	37,202	214,156	34	846	168	797,125
1955	3,558	522,200	660	45,220	258,011	210	210	221	830,290
1956	2,245	521,679	450	50,900	143,665	3,240	187	252	722,618
Kansas:									
1945-54 average	202,873	61,628	4,769	3,859	24,623	30,323	315	520	328,910
1955	128,385	34,104	12,728	3,350	30,882	33,246	16	690	243,401
1956	143,282	32,067	10,404	3,018	23,177	24,390	14	759	237,111
Michigan:									
1945-54 average	32,105	68,524	3,467	1,897	50,830	---	---	847	157,670
1955	27,966	93,186	3,468	3,036	57,068	---	---	620	185,344
1956	31,290	102,204	2,914	4,200	34,850	---	---	765	176,223
Minnesota:									
1945-54 average	18,579	238,754	27,608	18,961	193,267	---	12,377	2,204	511,750
1955	12,186	284,935	28,788	43,934	197,948	---	8,008	1,725	577,524
1956	17,218	329,705	28,275	52,540	167,583	---	9,950	1,584	606,855
Missouri:									
1945-54 average	27,976	141,798	2,510	20,616	36,203	667	---	491	230,261
1955	48,081	162,720	15,428	33,250	50,976	2,511	---	1,050	314,016
1956	49,800	189,408	11,826	39,120	42,129	5,610	---	765	338,658
Montana:									
1945-54 average	80,798	2,586	18,355	---	9,290	---	650	176	111,855
1955	109,350	3,999	40,620	---	10,840	---	672	340	165,821
1956	86,983	2,992	29,726	---	7,070	---	450	99	127,320
Nebraska:									
1945-54 average	80,211	220,863	7,028	1,297	59,800	3,556	---	2,249	375,004
1955	78,255	107,424	3,800	1,890	52,754	7,920	---	1,705	253,748
1956	63,044	116,864	2,280	1,748	15,588	12,446	---	1,674	213,644
New York:									
1945-54 average	10,613	27,688	2,382	96	25,869	---	---	252	66,900
1955	10,270	34,105	2,412	80	28,741	---	---	252	75,860
1956	9,610	34,104	2,368	112	24,684	---	---	308	71,186
North Dakota:									
1945-54 average	122,990	24,662	48,386	273	56,472	---	14,780	3,069	270,632
1955	109,336	31,118	81,698	1,364	54,740	---	24,578	8,816	311,650
1956	117,758	31,537	71,675	2,162	47,067	---	30,388	4,138	304,725
Ohio:									
1945-54 average	52,243	185,752	906	20,808	44,957	---	---	436	305,102
1955	43,384	220,955	4,294	29,228	63,801	---	---	656	362,318
1956	39,676	215,700	3,780	31,224	47,343	---	---	494	338,217
Pennsylvania:									
1945-54 average	19,832	61,501	5,492	400	26,509	---	---	286	114,020
1955	15,964	61,364	9,065	440	33,306	---	---	484	120,623
1956	15,579	71,736	8,550	388	28,918	---	---	504	125,675
South Dakota:									
1945-54 average	42,288	106,860	20,745	971	100,753	479	5,233	4,079	281,408
1955	27,461	87,318	9,198	2,794	98,736	976	5,783	4,088	236,354
1956	16,537	105,952	6,727	2,576	46,460	1,581	6,368	2,130	188,331
Wisconsin:									
1945-54 average	2,164	126,847	5,447	558	130,537	---	145	942	266,640
1955	1,419	137,000	2,590	975	138,915	---	62	550	281,511
1956	1,440	167,140	2,628	1,318	126,500	---	126	455	299,607
Wyoming:									
1945-54 average	6,089	1,009	3,940	---	4,305	---	---	64	15,407
1955	5,200	1,740	3,080	---	3,451	---	---	88	13,559
1956	5,101	1,408	2,700	---	3,100	---	---	100	12,409
Above 17 states:									
1945-54 average	817,902	2,524,309	166,869	224,843	1,173,374	37,920	34,346	17,829	4,998,022
1955	724,929	2,588,944	234,351	308,943	1,327,885	49,879	39,329	25,017	5,299,277
1956	713,481	2,835,666	199,121	376,382	961,028	50,199	47,483	16,457	5,200,217
United States:									
1945-54 average	1,148,289	3,084,389	278,166	253,653	1,327,496	141,334	37,959	21,558	6,292,844
1955	934,731	3,229,793	401,225	373,522	1,503,074	242,526	41,243	29,055	6,755,169
1956	997,207	3,451,292	372,495	455,869	1,152,652	205,065	48,712	21,558	6,704,850

Agricultural Statistics, 1956, U.S. Department of Agriculture; Crop Production, Crop Reporting Board, Dec. 17, 1956; The Northwestern Miller, Almanack Number, May 28, 1957.

TABLE 2.--U.S. Wheat: Inspections for export, by grades and classes, and by port area; crop years (July-June) 1951-52, 1954-55 through 1956-57

Port area & grade of wheat	Hard Red Spring and Durum				Hard Red Winter				Soft Red Winter			
	51-52	54-55	55-56	56-57	51-52	54-55	55-56	56-57	51-52	54-55	55-56	56-57
Atlantic Coast	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.
No. 1	49,432	1,751	6,154	14,635	5,350	4,545	9,850	12,951	--	14,078	14,658	1,430
No. 2	34,445	1,015	962	11,815	1,186	743	7,735	9,341	21,066	37,557	45,091	39,268
All other	5,883	15,740	12,402	2,945	--	--	--	--	257	187	717	1,121
Total	89,760	18,506	19,518	29,395	6,536	5,288	17,585	22,292	21,323	51,822	60,466	41,819
Gulf Coast												
No. 1	1,628	312	235	921	2,998	31,076	43,539	62,455	--	1,055	33	2
No. 2	3,925	825	--	--	156,372	43,272	44,121	55,226	842	5,538	4,497	7,707
All other	--	1,466	3,426	1,954	5,509	55	700	13,293	--	502	4	85
Total	5,553	2,603	3,661	2,875	164,879	74,403	88,360	130,974	842	7,095	4,534	7,794
Pacific Coast												
No. 1	94	1,135	148	1,649	29,486	8,140	6,652	20,823	40	32	--	--
No. 2	1,653	--	--	3,138	753	72	182	8,272	--	--	--	--
All other	1,159	6	--	--	--	2	--	--	--	--	--	--
Total	2,906	1,141	148	4,787	30,239	8,214	6,834	29,095	40	32	--	--
Grand Total	98,219	22,250	23,327	37,057	201,654	87,905	112,779	182,361	22,205	58,949	65,000	49,613

Port area & grade of wheat	White				Mixed				Totals--all classes			
	51-52	54-55	55-56	56-57	51-52	54-55	55-56	56-57	51-52	54-55	55-56	56-57
Atlantic Coast	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.
No. 1	356	652	2,429	866	249	1,605	5,302	2,914	55,387	22,631	38,393	32,796
No. 2	7,742	13,051	13,865	11,044	128	267	485	13,587	64,567	52,633	68,138	85,055
All other	1,477	18	--	1,281	199	--	--	66	7,816	15,945	13,119	5,413
Total	9,575	13,721	16,294	13,191	576	1,872	5,787	16,567	127,770	91,209	119,650	123,264
Gulf Coast												
No. 1	--	--	--	--	--	150	--	2,882	4,626	32,593	43,807	66,260
No. 2	--	--	--	--	253	--	--	3,612	161,392	49,635	48,618	66,545
All other	--	--	--	--	1,439	--	--	--	6,948	2,023	4,130	15,332
Total	--	--	--	--	1,692	150	--	6,494	172,966	84,251	96,555	148,137
Pacific Coast												
No. 1	83,781	25,053	53,631	132,243	47	--	--	6,353	113,448	34,360	60,431	161,068
No. 2	2,504	13,499	4,394	28,963	6	2	--	--	4,916	13,573	4,576	40,373
All other	--	--	--	116	--	--	--	--	1,159	8	--	116
Total	86,285	38,552	58,025	161,322	53	2	--	6,353	119,523	47,941	65,007	201,557
Grand Total	95,860	52,273	74,319	174,513	2,321	2,024	5,787	29,414	420,259	223,401	281,212	472,958

Source: World Wheat Statistics, January 1956, pp. 51-53, years 1951-1955. Grain Market News, July 12, July 13, years 1956, 1957.

TABLE 3. --Wheat production: 4 major exporting countries and Europe

Crop year	Europe	United States	Canada	Argentina	Australia
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
1947	1,005,000	1,359,000	339,000	239,000	220,000
1948	1,455,000	1,295,000	381,000	191,000	191,000
1949	1,500,000	1,098,000	366,000	189,000	218,000
1950	1,525,000	1,019,000	466,000	213,000	184,000
1951	1,580,000	981,000	554,000	77,000	160,000
1952	1,640,000	1,299,000	702,000	280,000	199,000
1953	1,730,000	1,169,000	614,000	228,000	198,000
1954	1,720,000	985,000	309,000	283,000	167,000
1955	1,384,000	935,000	494,000	193,000	196,000
1956[1]	1,195,000	997,000	538,000	220,000	130,000
Average	1,473,400	1,113,700	476,300	211,300	186,300

[1] Preliminary.

Minneapolis Grain Exchange Annual Report 1956. p. 75.

TABLE 4.--Grain and soybean traffic through New York State Barge Canal, 1953-1956

Movement, port, and year	Wheat	Corn	Rye and barley	Soybeans	Oats	Flaxseed
Receipts by lake boat at:	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
Buffalo, N. Y.						
1953	57,331	13,472	1,801	---	61	2,063
1954	66,694	17,550	7,271	---	4,609	5,539
1955	56,274	5,648	16,764	---	5,937	5,346
1956	80,572	4,072	20,037	---	10,179	4,133
Oswego, N. Y.						
1953	2,439	3,212	562	207	---	456
1954	5,453	1,318	1,283	---	---	2,626
1955	7,395	6,654	5,759	---	1,427	2,568
1956	5,505	676	3,406	---	---	2,423
Shipments by barge from:						
Buffalo, N. Y.						
1953	650	488	---	---	---	---
1954	330	384	91	---	---	1,458
1955	353	500	319	---	---	1,471
1956	966	148	416	---	2,418	868
Oswego, N. Y.						
1953	4,870	3,387	600	465	104	---
1954	5,743	987	839	65	237	2,598
1955	7,256	1,260	5,350	---	1,451	---
1956	6,416	740	2,646	---	---	2,416
Receipts by barge at:						
Albany, N. Y.						
1953	5,462	3,790	600	283	104	---
1954	5,722	1,246	930	65	121	2,458
1955	7,202	1,526	5,484	---	1,450	2,713
1956	6,323	852	2,780	---	2,418	2,486
New York City, N. Y.						
1953	57	86	---	182	---	---
1954	352	125	---	---	117	1,598
1955	407	234	184	73	---	1,457
1956	1,059	35	283	---	---	798

Waterborne Commerce, annual reports covering 1953-1956. Annual Reports, State of New York, Department of Public Works. (Statistical Appendices, Barge Canal Trade and Tonnage.)

TABLE 5. --Receipts of grains and soybeans at selected ports

Port and year	Mode of tranaport[1]								Commodity								Total grains and oil aeeda
	Truck		Rail		Barge		Lake boat		Wheat	Corn	Barley	Oata	Rye	Sorghum	Flax-aeed	Soy-beana	
	Soy-beans	Grains	Soy-beana	Grains	Soy-beans	Grains	Soy-beana	Grains									
	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels
Chicago, Ill.:																	
1952	2,447	6,860	14,184	134,198	8,195	45,181	---	23,020	28,187	127,159	13,279	36,254	4,380	---	1,286	24,826	235,371
1953	2,720	6,218	13,224	117,870	8,128	34,873	---	15,416	24,873	103,176	14,399	20,849	11,080	---	1,052	24,072	199,501
1954	3,794	8,699	14,931	126,636	5,205	27,247	---	4,914	27,103	101,920	13,146	22,220	3,107	---	1,042	23,930	192,468
1955	5,721	6,048	15,433	131,945	8,672	28,926	---	1,657	24,946	96,888	12,957	32,435	1,350	---	812	29,826	199,214
1956	6,222	7,138	10,873	120,173	15,668	42,966	331	3,948	30,918	98,037	12,582	28,150	4,534	---	195	33,094	207,510
Kanaaa City, Mo.:																	
1952	([2])	1,358	([2])	183,103	---	---	---	---	129,099	35,861	1,491	5,822	297	6,176	---	5,715	184,461
1953	([2])	2,671	([2])	147,548	---	---	---	---	107,559	30,970	611	4,024	249	2,779	---	4,027	150,219
1954	([2])	3,122	([2])	144,063	---	131	---	---	98,832	27,950	777	3,239	172	10,353	---	5,993	147,316
1955	([2])	3,029	([2])	134,291	---	72	---	---	100,681	18,967	978	3,172	217	4,836	---	8,541	137,392
1956	([2])	[3] 5,655	([2])	[3]127,719	---	---	---	---	101,128	18,308	815	2,275	214	4,607	---	6,027	133,374
St. Louis, Mo.-East St.Louis, Ill.:																	
1952	1,450	15,584	3,403	73,203	---	8,041	---	---	34,999	49,440	1,590	9,846	52	901	---	4,853	101,681
1953	1,822	20,525	1,632	71,733	1,801	9,570	---	---	37,790	53,356	1,732	8,264	30	656	---	5,255	107,083
1954	1,606	13,900	1,541	63,156	1,423	7,530	---	---	37,906	36,314	2,206	6,659	40	1,432	---	4,570	89,127
1955	4,333	15,702	2,592	60,032	1,972	9,305	---	---	43,790	32,381	1,804	5,787	494	784	---	8,897	93,937
1956	6,037	27,998	3,559	63,209	954	5,593	---	---	38,950	49,278	2,090	4,780	114	1,589	---	10,550	107,351
Toledo, Ohio:																	
1952	983	3,480	([2])	47,012	---	---	---	425	24,286	17,309	240	4,355	24	---	---	5,686	51,900
1953	1,110	5,979	([2])	62,073	---	---	---	325	32,126	25,087	202	4,574	46	---	---	7,452	69,487
1954	1,358	5,827	([2])	81,404	---	---	---	785	39,468	33,476	153	7,857	102	---	---	8,318	89,374
1955	2,400	12,530	([2])	83,955	---	---	---	---	29,050	46,981	328	10,443	139	---	---	11,944	98,885
1956	2,000	12,213	([2])	90,424	---	---	---	---	32,499	49,301	280	13,486	55	---	---	9,016	104,637
Minneapolis-St. Paul, Minn.:[4]																	
1953	7	1,247	1,624	175,487	---	---	---	---	74,959	14,768	40,777	16,791	5,122	---	24,317	1,631	178,365
1954	120	1,333	2,502	180,124	---	---	---	---	74,130	19,235	43,052	17,078	3,514	---	24,448	2,622	184,079
1955	4,873	5,050	5,672	195,530	---	---	---	---	67,999	23,482	48,501	26,705	5,347	---	28,546	10,545	211,125
1956	13,137	8,638	10,126	215,811	---	---	---	---	72,323	27,820	59,360	22.373	9,608	---	32,965	23,263	247,712

[1] Flaxaeed not included.
[2] Included under grains.
[3] Estimated.
[4] Data are for crop yeara, July through June.

Chicago: Annual Reports of the Board of Trade of Chicago; Kansas City: Northweatern Miller, Almanack Number, May 28, 1957, p. 86; The Board of Trade; and Annual Raporta of the Minneapolia Grain Exchange. St. Louia-Eaat St. Louis: Annual Reporta of the St. Louia Merchanta Exchange. Toledo: Annual Reporta of the Toledo Board of Trade; "A Program for the Port of Toledo;" and Waterborne Commerce of the U. S., 1954, p. 57. Minneapolis-St. Paul: Minneapolia Grain Exchange.

TABLE 6.--Selected traffic movements of grain on the Mississippi River to Baton Rouge and New Orleans, La., and foreign exports from these ports, calendar years 1953 through 1956

Commodity	1953		1954		1955		1956	
	Barge receipts	Foreign exports	Barge receipts	Foreign exports	Barge receipts	Foreign exports	Barge receipts	Foreign exports
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
Wheat	6,973	16,389	10,701	22,927	10,254	24,784	16,372	32,821
Corn	24,557	46,572	16,106	21,601	11,827	17,905	19,800	29,838
Barley and rye	---	1	1,252	933	3,579	4,710	3,784	5,700
Soybeans	6,763	17,543	11,030	19,642	22,159	40,314	17,484	33,999
Oats	390	72	559	357	2,531	2,441	3,219	6,005
Flaxseed	---	1	---	1	---	---	210	468
Other grains[1]	1,216	---	2,423	607	4,362	3,914	4,976	1,392
Total	39,899	80,578	42,071	66,068	54,712	94,068	65,845	110,223
Percent, barge receipts of foreign exports	49.51		63.68		58.16		59.74	

[1] Rice is excluded.

Traffic statistics for the inland waterways of the United States are compiled by the Corps of Engineers, Department of the Army and are published annually in "Waterborne Commerce of the United States." Barge receipts are in net tons of 2,000 pounds and are the domestic internal receipts. The data have been converted to bushels as follows: Wheat and soybeans, 33.33 bushels per ton; corn and flaxseed, 35.71 bushels; barley and rye, 41.67 bushels; oats, 62.50 bushels; and other grain and grain sorghums, average 40 bushels. Since a considerable volume of grain is stored from 1 year to another in grain elevators and since the percentage of barge receipts actually exported is unknown, the above data are only indicative of the possible importance of barge receipts to foreign exports. Both the grain elevators at Baton Rouge and at New Orleans are used principally as exporting elevators and it is believed a high percentage of barge-received grain moves into foreign export trade.

TABLE 7.--Total wheat, corn, oats, and soybean traffic on the Illinois Waterway, Grafton, Ill. to Lockport, Ill., inclusive, calendar years 1951 through 1956

Year	Downstream to the Mississippi River	Upstream to Chicago, Ill.	Total traffic	Downstream--Percent of total	Upstream--Percent of total
	Net tons	*Net tons*	*Net tons*	*Percent*	*Percent*
1951	403,254	1,160,069	1,563,323	25.8	74.2
1952	540,845	1,265,899	1,806,744	29.9	70.1
1953	823,691	940,777	1,764,468	46.7	53.3
1954	939,410	675,929	1,615,339	58.2	41.8
1955	837,341	718,270	1,555,611	53.8	46.2
1956	633,973	1,059,951	1,693,924	37.4	62.6

Traffic statistics for the inland waterways of the United States are compiled by the Corps of Engineers, Department of the Army, and are reported in their annual issues of "Waterborne Commerce of the United States." The above analysis was furnished by the Chicago Board of Trade, except for the 1956 data. That moving downstream is the outbound-downbound tonnage. The upstream to Chicago movement is the total of internal shipments.

TABLE 8.--Growth of Tennessee River grain, soybean, and grain products traffic for selected ports, 1942, 1952, and 1956, and estimated 1957 traffic[1]

Year	Total	Chattanooga, Tenn.	Decatur, Ala.	Guntersville, Ala.	Knoxville, Tenn.
	Tons	*Tons*	*Tons*	*Tons*	*Tons*
1942.....	91,400	32,500	31,400	27,500	---
1952.....	204,400	11,600	56,400	134,900	1,500
1956[2].....	649,800	406,400	63,600	145,300	34,500
1957[3].....	1,079,400	---	---	---	---

[1] The traffic is for calendar years in net tons of 2,000 pounds.
[2] Traffic for 1956 includes the following: Corn, 334,032 tons; wheat, 116,811 tons; oats, 27,429 tons; wheat flour and semolina, 5,220 tons; flour, flour grain preparations, etc., 9,893 tons; soybeans, 149,299 tons; and other grains, 7,088 tons. Practically all of this traffic moved upstream from other sections of the inland waterways system.
[3] Preliminary.

Traffic statistics for the inland waterways of the United States are compiled by the Corps of Engineers, Department of the Army, and are reported in their annual issues of "Waterborne Commerce of the United States." The port data were derived from or based on tonnage graphs of Tennessee River traffic, furnished by the Tennessee Valley Authority, Knoxville, Tenn.

TABLE 9.--Rail grain traffic into selected areas based on the (ICC) 1-percent sample of terminations, 1956[1]

Destination area	Commodity							Total
	Wheat	Corn	Barley and rye	Soybeans	Oats	Sorghum grains	Flaxseed	
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
New England[2].....	13,757	15,368	1,821	---	2,287	---	---	33,233
Mid-Atlantic[3].....	146,187	130,093	20,938	2,400	46,743	856	107	347,324
Southeastern[4].....	817	1,339	---	---	412	224	---	2,792

[1] Rail grain traffic to New England and to the Mid-Atlantic destination areas is from the following selected States: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, New York, Ohio, and Wisconsin. New York origin data were selected to include only the ex-lake movements. In addition to these States, for movements into the Southeastern destination area, Tennessee has been included as an origin State since a comparatively small but significant volume of ex-barge grain moves by rail from Memphis, Tenn., to selected southeastern States.
[2] Included are: Connecticut, Maine, Massachusetts, New Hampshire, and Rhode Island.
[3] Included are: Delaware, District of Columbia, Maryland, Virginia, New Jersey, New York, and Pennsylvania.
[4] Included are: Florida, Georgia, North Carolina, and South Carolina.

Data are based on information in Statement SS-2, "Carload Waybill Statistics 1956," Bureau of Transport Economics, Interstate Commerce Commission. Net tons of 2,000 pounds have been converted to bushels as follows: Wheat and soybeans, 33.33 bushels per ton; corn, grain sorghums, and flaxseed, 35.71 bushels; barley and rye, 41.67 bushels; oats, 62.50 bushels. For further clarification regarding ICC sampling methods, etc., see Statement No. 543, "Waybill Statistics, Their History and Uses," Bureau of Transport Economics, Interstate Commerce Commission.

TABLE 10.--Estimated domestic grain deficits in selected U. S. market areas that can be served by the Great Lakes-St. Lawrence Waterway, 1956[1]

Destination areas	Domestic import movements by		Total	Foreign exports	Net deficit[2]
	Rail	Barge			
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
New England[3].....	33,233	---	33,233	22,732	10,501
Mid-Atlantic[4].....	347,324	17,034	364,358	255,511	108,847
Southeastern[5].....	2,792	11,435	14,227	---	14,227

[1] The commodities included are wheat, corn, barley and rye, soybeans, oats, grain sorghums, and flaxseed. Data in net tons of 2,000 pounds have been converted to bushels as follows: Wheat and soybeans, 33.33 bushels per ton; corn, grain sorghums, and flaxseed, 35.71 bushels; barley and rye, 41.67 bushels; oats, 62.50 bushels. The rail data are from table 9, entitled "Rail grain traffic into selected areas based on the (ICC) 1 percent sample of terminations, 1956." Barge movements are given in tables 4 and 8, and are based on data from Part II, Waterborne Commerce of the United States, Calendar Year 1956, issued by the Corps of Engineers, U. S. Army. Foreign export data are from table 18, based on Part I of the same annual report. New England exports represent those moving from the ports of Portland, Me., and Boston, Mass. Mid-Atlantic exports are those moving from the ports of New York, N. Y., Albany, N. Y., Philadelphia, Pa., Baltimore, Md., and Norfolk, Va.

[2] It is recognized that truck volumes moving from the selected States of origin to the selected areas of destination may be significant. However, except for an estimated 50 percent of Tennessee River port receipts of grain by barge, table 8, assumed to move to the States included in the southeastern destination area, no trucking volume statistics have been included.

[3] Connecticut, Maine, Massachusetts, New Hampshire, and Rhode Island are included.

[4] Delaware, District of Columbia, Maryland, Virginia, New Jersey, New York, and Pennsylvania are included.

[5] Florida, Georgia, North Carolina, and South Carolina are included.

TABLE 11.--Wheat (grain only) and flour (wheat equivalents) combined: U. S. exports by country of destination, averages 1935-39, 1945-49, 1945-54, and 1950-54; annual 1955 and 1956[1]

Country of destination	Average 1935-39	Average 1945-49	Average 1945-54	Average 1950-54	1955	1956
North, Central, and South America (including Caribbean):	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels
Canada	2,803	540	580	621	1,804	325
Mexico	1,232	11,482	10,968	10,453	4,062	85
Central America	1,151	2,391	2,913	3,435	5,168	5,682
British West Indies	114	937	1,436	1,935	2,553	3,655
Netherlands Antilles	65	184	181	178	275	---
British Guiana	114	(2)	187	374	1,144	1,048
Surinam (Netherlands Guiana)	(2)	65	87	109	151	---
Cuba	1,729	6,011	5,339	4,667	6,135	7,535
Haiti	(2)	447	737	1,028	1,302	---
Dominican Republic	(2)	256	358	460	538	---
Colombia	177	700	755	811	3,034	2,997
Ecuador	419	1,024	1,009	994	815	---
Venezuela	259	1,867	2,242	2,616	4,917	6,340
Peru	(2)	2,277	2,506	2,734	3,578	4,392
Bolivia	(2)	408	683	958	3,729	4,275
Brazil	49	10,472	12,170	13,867	17,736	13,921
Chile	---	---	---	---	1,393	7,503
Other	395	2,631	3,875	5,119	28	4,794
Total	8,507	41,692	46,026	50,359	58,362	62,552
Europe:						
Austria	(2)	14,930	10,484	6,037	2,251	2,785
Belgium-Luxembourg	6,515	11,867	11,122	10,376	7,110	17,962
Denmark	7	384	666	948	986	3,577
Finland	---	---	---	---	926	3,273
France	389	18,540	10,933	3,326	7,944	30,931
Greece	578	18,617	15,480	12,343	13,245	19,601
Germany	861	91,664	67,406	43,147	16,823	35,502
Ireland (Eire)	3,759	1,749	1,397	1,045	385	---
Italy	445	43,115	27,246	11,376	7,117	12,954
Netherlands	8,064	19,816	18,001	16,186	23,603	21,378
Norway	665	5,000	4,825	4,651	3,253	2,860
Portugal	(2)	6,592	4,885	3,178	3,497	5,862
Spain	(2)	860	3,408	5,956	1,270	---
Sweden	(2)	403	882	1,362	---	---
Switzerland	165	3,184	2,992	2,800	1,711	8,532
Trieate	(3)	(3)	420	840	---	---
United Kingdom	11,465	14,660	17,892	21,124	24,870	39,791
Yugoslavia	(2)	3,155	8,809	14,464	37,753	37,707
Malta, Gozo and Cyprus	(2)	---	245	490	707	---
Azores	(2)	81	88	95	---	---
Iceland	(2)	121	137	153	---	---
Other	2,357	21,403	11,185	967	71	2,438
Total	35,270	276,141	218,503	160,864	153,522	245,153
Aaia and Oceania:						
Turkey	---	---	---	---	9,098	21,917
Lebanon	---	306	1,199	2,092	3,213	2,254
Indo China	---	---	---	---	1,667	3,604
Jordan	---	---	90	181	---	---
Iran (Persia)	---	---	---	---	1,950	2,886
Israel	---	451	3,230	6,009	8,678	10,593
Saudi Arabia	---	135	761	1,388	2,257	4,005
Ceylon	---	1,666	1,025	384	---	---
Kuwait	---	---	46	92	286	---
Indonesia	---	2,647	2,058	1,470	961	4,022
Philippines, Republic of	3,14.	5,851	5,159	4,466	4,844	6,115
Portuguese Asia	---	---	76	152	114	---
Hong Kong	923	438	392	347	389	---
India	---	11,567	22,062	32,556	8,967	66,647
Pakistan	---	---	3,049	6,098	4,837	22,619
Korea, Republic of	---	3,317	2,757	2,198	4,810	16,606
China	3,001	5,515	2,758	---	---	---
Taiwan (Formosa)	---	---	2,008	4,016	7,422	8,210
Japan	221	38,869	38,711	38,552	40,968	49,923
Other	---	4,558	3,933	3,307	654	3,831
Total	7,288	75,320	89,314	103,308	101,110	223,232
Africa:						
Egypt	26	1,455	4,629	7,802	19,251	1,441
Gold Coast	---	198	480	762	1,188	---
Nigeria	---	---	271	543	1,412	---
British W. Africa	9	58	90	122	2,780	3,768
Angola	---	133	262	391	---	---
Belgian Congo	---	133	204	276	---	---
Mozambique	---	184	153	122	---	---
French Morroco	---	---	---	---	757	---
French N. Africa	---	7,501	4,550	1,598	---	---
French West Africa	---	---	---	---	158	2,572
Canary Islands	---	---	276	553	2,190	165
Madeira Islands	---	---	---	---	---	---
Union of S. Africa	---	739	1,219	1,699	1,082	566
Algeria	---	---	---	---	1,643	142
Tunisia	---	---	---	---	724	3,100
Other	---	1,688	1,352	1,015	410	3,240
Total	35	12,089	13,486	14,883	31,595	14,994
Unspecified	3,192	21,456	10,728	---	---	90
World total	54,292	426,698	378,057	329,414	344,589	546,021

[1] Years beginning July 1.
[2] Exports, if any, included in "Other."
[3] Included with Italy.

Source: Foreign Crops and Markets, August 19, 1957, p. 19; Statistical Bulletin #179, Foreign Agr. Serv.; and Foreign Agr. Trade, Jan. 1957.

TABLE 12.--Corn, grain: U. S. exports by country of destination; averages 1935-39, 1945-49, 1945-54, and 1950-54, annual 1955 and 1956[1]

Country of destination	Average[2]				1955[2]	1956[2]
	1935-39	1945-49	1945-54	1950-54		
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
North America:						
Canada	16,012	9,069	9,993	10,916	3,442	14,359
Cuba	1	39	22	5	---	450
Mexico	632	133	2,624	5,115	1,810	9,947
Other	184	136	112	88	3,369	880
Central America:						
El Salvador	([3])	---	121	243	1,096	---
All Central American countries	---	---	---	---	---	226
South America:						
Venezuela	([3])	298	203	107	7	293
Other	---	---	---	---	---	563
Total	16,829	9,675	13,075	16,474	9,724	26,718
Europe:						
Austria	([3])	2,986	4,655	6,323	9,724	7,319
Belgium-Luxembourg	1,080	1,861	5,454	9,046	12,077	12,325
Denmark	1,248	2,001	1,100	199	678	203
Finland	---	---	---	---	759	414
France	([3])	5,996	5,270	4,543	4,045	801
West Germany[4]	2,814	19,785	2,229	4,673	6,466	12,405
Greece	([3])	831	484	138	1,723	3,019
Ireland (Eire)	3,160	3,689	3,928	4,168	3,715	350
Italy	([3])	3,815	3,257	2,700	2,853	2,105
Netherlands	5,572	3,129	6,397	9,664	13,957	13,258
Norway	265	1,462	2,098	2,734	1,962	2,078
Spain	([3])	---	188	376	1,929	1,543
Sweden	([3])	---	53	107	---	87
Switzerland	([3])	460	536	613	819	553
Trieste	([5])	([5])	680	1,361	1,149	([6])
United Kingdom	9,428	2,972	15,303	27,633	45,047	44,640
Yugoslavia	([3])	171	1,278	2,385	29	568
Other	623	2,246	1,264	282	628	152
Total	24,190	51,404	64,174	76,945	105,994	101,820
Asia:						
Israel	([3])	95	120	146	---	2,862
India	([3])	1,226	819	412	---	([7])
Japan	([3])	5,582	4,552	3,521	3,125	9,930
Egypt	([3])	739	438	137	---	---
Canary Islands	([3])	468	517	565	702	702
Turkey	([3])	([3])	---	([3])	---	1,944
Africa:						
British East Africa	([3])	---	177	355	---	---
Union of S. Africa	([3])	---	871	1,741	---	([7])
Unspecified	87	365	265	166	122	729
Total	87	8,475	7,759	7,043	3,949	[8] 16,167
World total	41,106	69,554	85,008	100,462	119,667	144,713

[1] Includes seed corn, except sweet corn seed.
[2] Years beginning July 1.
[3] Exports, if any, included in "other" or "unspecified."
[4] Prior to July 1, 1952, reported as Germany.
[5] Included with Italy.
[6] Included with Yugoslavia.
[7] Less than 500 bushels.
[8] Excludes 8,576,000 bushels under Section 416.

Statistical Bulletin No. 179, Foreign Agricultural Service, August 1956; Foreign Agricultural Trade of U. S., FAS, January 1957; Feed and Feed Grains Section, Agricultural Economics Division, AMS.

TABLE 13.--Barley, grain: U. S. exports by country of destination; averages 1935-39, 1945-49, 1945-54, and 1950-54 and annual 1955 and 1956[1]

Country of destination	Average[2]				1955[2]	1956[2]
	1935-39	1945-49	1945-54	1950-54		
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
North America:						
Canada	1,692	61	696	1,331	12	([3])
Mexico	143	232	344	455	674	1,426
South America:						
Columbia	([4])	([4])	24	47	---	---
Chile	([4])	([4])	18	36	---	---
Venezuela	([4])	([4])	2	4	---	6
Other	2	2	1	2	264	996
Total	1,837	295	1,085	1,875	950	2,428
Europe:						
Belgium-Luxembourg	518	355	1,834	3,313	28,544	3,559
France	([4])	243	126	9	145	---
Greece	([4])	217	108	---	---	1,215
Germany	70	3,167	1,600	33	[5] 9,496	5,327
Italy	([4])	([4])	18	36	---	---
Netherlands	709	675	1,563	2,451	26,037	6,593
Norway	([4])	21	211	401	814	163
Switzerland	([4])	144	485	826	2,193	70
United Kingdom	6,043	([4])	27	55	1,808	113
Yugoslavia	([4])	([4])	185	369	---	---
Spain	---	---	---	---	1,538	3,760
Other	357	663	345	26	320	513
Total	7,697	5,485	6,502	7,519	70,895	21,313
Other Countries:						
Turkey	([4])	---	385	769	2,946	1,289
Korea, Republic of	([4])	527	2,192	3,857	3,591	17,992
Taiwan (Formosa)	([4])	---	129	258	---	---
Japan	([4])	7,691	10,558	13,424	16,863	14,562
Other	8	377	189	2	2,995	20
Total	8	8,595	13,453	18,310	26,395	33,863
World total	9,542	14,375	21,040	27,704	98,240	57,604

[1] Does not include pearl barley and malt.
[2] Years beginning July 1.
[3] Less than 500 bushels.
[4] Exports, if any, included in other.
[5] Includes West Germany only.

Averages and years 1950-1954 compiled from Statistical Bulletin #179, FAS, Aug. 1956. Years 1955 and 1956 compiled from Grain Market News, Grain Division, AMS, Vol. V, No. 32, Aug. 9, 1957.

TABLE 14.--Soybeans and soybean oil: U. S. exports by country of destination, averages 1945-49, 1945-54, 1950-54; annual 1955 and 1956[1]

Country of destination	Average			1955[2]	1956[2]
	1945-49	1945-54	1950-54		
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
North America					
Canada	2,288	4,355	6,422	9,964	11,651
Cuba	946	846	746	620	964
Other	359	436	512	374	1,902
Total	3,593	5,637	7,680	10,958	14,517
South America					
Chile	---	---	---	---	3,970
Other	188	348	509	194	73
Total	188	348	509	194	4,043
Europe					
Austria	([3])	---	---	37	---
Belgium-Luxembourg	1,271	1,296	1,320	1,466	2,648
Denmark	500	778	1,056	3,947	4,083
Finland	---	16	33	186	149
France	2,100	1,728	1,355	2,998	1,633
West Germany[4]	3,545	5,500	7,454	11,316	12,524
Greece	541	393	246	2,220	5,714
Iceland	122	100	79	28	24
Italy	1,745	2,384	3,022	29	4,905
Netherlands	1,410	3,598	5,786	8,259	11,311
Norway	363	479	595	824	801
Spain	1,274	2,378	3,481	6,626	36,630
Sweden	([5])	52	104	([5])	799
Switzerland	437	576	715	447	59
United Kingdom	399	850	1,301	2,349	885
Yugoslavia	---	18	37	---	---
Other	1,637	1,386	1,135	---	---
Total	15,344	21,532	27,719	40,732	82,165
Asia					
Japan	1,548	6,683	11,819	21,937	19,148
Taiwan (Formosa)	---	694	1,388	4,016	4,085
Other	264	1,217	2,170	2,691	2,770
Total	1,812	8,594	15,377	28,644	26,003
Africa	250	321	392	218	4,485
Australia and Oceania	32	102	172	10	13
Other	---	---	---	[6] 23	---
Grand total	21,219	36,534	51,849	80,779	131,226

[1] Soybean oil is converted to bushels of soybeans. The exports are on a calendar year basis.
[2] Preliminary.
[3] Austria included with Germany.
[4] Prior to January 1952 reported as Germany.
[5] Less than 500 bushels.
[6] Represents 23,000 bushels, the destination for which has not been designated.

Source: Foreign Agricultural Trade, Statistical Handbook No. 179, FAS, August 1956; Fats and Oils Division, FAS.

TABLE 15.--Oats, (Grain, including seed oats): U. S. exports by country of destination, averages 1935-39, 1945-49, 1945-54, and 1950-54; annual 1955 and 1956[1]

Country of destination	Average 1935-39	Average 1945-49	Average 1945-54	Average 1950-54	1955	1956
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
North, Central and South America (including Caribbean)						
Canada	2,955	273	144	15	12	6
Mexico	45	99	107	114	6	220
Cuba	124	330	232	134	341	269
Dominican Republic	4	16	12	8	---	12
Other	43	127	79	32	30	18
Total	3,171	845	574	303	389	525
Europe						
Sweden	(2)	226	138	50	294	---
United Kingdom	12	127	63	---	---	500
Netherlands	(2)	1,587	137	1,168	14,701	13,991
Belgium-Luxembourg	20	980	568	156	6,880	7,935
France	(2)	1,527	764	---	---	---
Germany[3]	(2)	4,733	2,405	77	422	---
Switzerland	(2)	520	341	162	1,379	379
Finland	17	197	98	---	---	---
Yugoslavia	(2)	313	575	837	---	---
Greece	(2)	1,350	887	423	1,306	955
Other	29	1,218	610	2	---	---
Total	78	12,778	7,827	2,875	24,982	23,760
Other Countries						
Turkey	(4)	---	348	696	---	---
Miscellaneous	20	1,848	936	24	---	---
Unspecified	7	614	307	---	237	34
Total	27	2,462	1,591	720	237	34
World Total	3,276	16,085	9,992	3,898	25,608	24,319

[1] Years beginning July 1.
[2] Exports, if any, included in "Other".
[3] Postwar figures include West Germany only, beginning July 1, 1952.
[4] Exports, if any, included in "Unspecified", under "Other countries".

Source: Averages and years 1950-54 compiled from Statistical Bulletin #179, FAS, August 1956; years 1955 and 1956 compiled from Grain Market News, Grain Division, August 9, 1957.

TABLE 16. --Grain sorghums: U. S. exports by country of destination, averages: 1945-49, 1945-54, and 1950-54; annual 1955 and 1956[1]

Country of destination	Average 1945-49	Average 1945-54	Average 1950-54	1955	1956
North, South and Central America (including Caribbean)	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
Canada	1	5	9	---	---
Mexico	2	8	14	---	---
Cuba	3	1	---	---	---
British W. Indies	1	1	---	---	---
Venezuela	1	1	---	---	---
Other	---	---	1	---	---
Total	8	16	24	---	---
Europe					
Sweden	---	229	459	---	---
Norway	203	826	1,448	5,769	1,324
Denmark	---	485	969	---	---
United Kingdom	---	1,242	2,484	15,819	5,238
Ireland (Eire)	---	1,237	2,473	---	---
Netherlands	298	1,594	2,890	9,809	6,788
Belgium-Luxembourg	219	1,697	3,174	11,211	5,924
France	111	100	89	---	---
Germany (West only)	7,266	8,582	9,897	---	---
Austria	12	347	682	---	---
Switzerland	7	58	109	---	---
Finland	---	19	39	---	---
Poland	16	8	---	---	---
Trieste	---	39	79	---	---
Yugoslavia	50	123	197	---	---
Greece	46	23	---	---	---
Total	8,228	16,609	24,989	42,608	19,274
Other Countries					
Israel	99	726	1,353	4,720	1,329
Aden	61	30	---	---	---
India	8,681	10,581	12,481	---	---
Pakistan	1	1	---	---	---
Ceylon	351	175	---	---	---
Korea, Rep. of	([2])	901	1,802	---	---
Hong Kong	79	39	---	---	---
Japan	1,658	1,083	507	2,461	---
Australia	64	32	---	---	---
French Morocco	13	6	---	---	---
Unspecified	---	1	1	23,045	8,393
Total	11,007	13,575	16,144	30,226	9,722
World Total	19,243	30,200	41,157	72,834	28,996

[1] Years beginning July 1.
[2] Included with Japan.

Source: Average 1945-49 and years 1950-54 from FAS, Statistical Handbook #179. Years 1955 and 1956 from Foreign Agr. Trade, Stat. Report for June 1957.

TABLE 17.--Flaxseed and linseed oil: U. S. exports by country of destination, average 1950-54; annual 1955 and 1956[1]

Country of destination	Average 1950-54	1955	1956[2]
	Bushels	*Bushels*	*Bushels*
North America and Central America (including Caribbean)			
Canada	357,413	88,468	1,272,254
Costa Rica	458	---	---
Cuba	87,064	70,924	55,287
El Salvador	807	---	---
Mexico	14,580	50,726	7,432
Panama	1,119	---	505
Other	7,776	2,320	3,127
Total	469,217	212,438	1,338,605
South America			
Chile	11	---	---
Colombia	18,705	15,133	43,701
Venezuela	15,986	14,023	11,198
Other	8,684	4,944	8,702
Total	43,386	34,100	63,601
Europe			
Belgium-Luxembourg	1,073,622	1,320,581	2,856,167
Denmark	14,624	---	---
France	45,443	883,416	1,547,192
West Germany	216,985	---	1,140,726
Greece	605	---	---
Iceland	21	---	---
Italy	90,309	36,101	33,394
Ireland	6,526	---	---
Netherlands	6,375,196	5,786,777	5,059,291
Norway	218,146	406,063	321,052
Spain	5,246	605	73,648
Switzerland	94,036	310,779	40,658
Trieste	1,342	---	---
United Kingdom	815,331	2,724,609	556,901
Yugoslavia	13,599	---	---
Other	3,531	---	1,110
Total	8,974,562	11,468,931	11,630,139
Asia			
Israel	8,889	21,200	21,500
Japan	187,390	270,594	296,229
Other	74	---	---
Total	248,613	416,391	472,390
Africa	14,616	---	101
Australia and Oceania	4,940	302	---
World total	9,755,334	12,132,162	13,504,836

[1] Linseed oil is converted to bushels of flaxseed. The export volume was very small, 1935-49 and is not included below. The exports are on a calendar year basis.
[2] Preliminary.

Source: Foreign Agricultural Service, Fats and Oils Division.

TABLE 18. --Grains: Exports from the United States, by ports, calendar years 1950, 1955, and 1956

Port of export	Wheat			Wheat flour and semi-nola (wheat equivalent)			Oats			Rye and barley		
	1950	1955	1956	1950	1955	1956	1950	1955	1956	1950	1955	1956
	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels
Atlantic Ports												
Portland, Maine.....	1,605	2,112	1,501	---	613	1,294	---	---	500	1,713	---	---
Boston, Mass.	3,370	2,173	13,619	42	40	5	---	---	409	52	2,122	1,381
New York, N. Y.	9,307	7,656	17,873	15,085	12,236	10,400	285	1,691	2,092	29	2,518	4,287
Albany, N. Y.	10,872	13,743	20,458	---	---	---	---	5,911	4,643	719	4,784	8,048
Philadelphia, Pa.	9,992	12,851	28,725	222	89	55	99	1,454	461	167	2,178	1,506
Baltimore, Md.	13,473	21,994	50,456	2,246	1,015	457	356	5,075	4,794	4,832	8,454	8,952
Norfolk, Va.	1,195	6,652	16,159	115	95	41	---	5,524	5,889	---	9,744	2,547
Total.....	49,814	67,181	148,791	17,710	14,088	12,252	740	19,655	18,788	7,512	29,800	26,721
Gulf Ports												
New Orleans, La.	14,636	22,331	23,601	12,185	13,530	16,228	39	2,047	2,681	---	3,655	3,287
Baton Rouge, La.	---	2,453	9,220	---	---	---	---	394	3,324	---	1,055	2,413
Galveston, Tex.	46,789	36,331	56,344	4,244	4,892	6,104	---	174	1,550	---	76	3,365
Corpus Christi, Tex. ..	---	827	743	43	239	166	---	---	224	---	---	---
Houston, Tex.	19,458	15,928	30,972	2,653	4,186	5,333	---	280	515	---	142	347
Mobile, Ala.	---	4,085	3,790	328	337	476	---	---	2,219	---	---	1,176
Total.....	80,883	81,955	124,670	19,453	23,184	28,307	39	2,895	10,513	---	4,928	10,588
Pacific Ports												
Seattle, Wash.	3,903	6,958	14,116	2,456	2,033	1,964	1	522	---	582	3,630	9,912
Tacoma, Wash.	3,254	10,661	20,188	1,647	2,435	3,018	---	---	---	---	5,569	2,686
Portland, Oreg.	6,580	18,724	36,646	1,802	3,153	3,017	2	297	525	78	7,073	6,854
Vancouver, Wash.	2,134	17,491	21,558	12	723	361	---	192	193	---	8,907	7,138
Longview, Wash.	3,648	10,716	24,001	93	2	3	---	441	175	163	5,861	9,369
Astoria, Oreg.	1,124	1,312	5,292	822	2,608	3,159	---	---	---	---	---	---
Oakland, Calif.	31	399	1,141	116	15	32	---	1	2	1,825	3,827	1,760
San Francisco, Calif. .	363	1,797	1,743	73	85	75	---	---	4	5,139	2,230	4,496
Stockton, Calif.	---	118	451	---	---	---	(1)	---	200	374	4,161	14,030
Total.....	21,037	68,176	125,136	7,021	11,054	11,629	3	1,453	1,099	8,161	41,258	56,245
Grand total, above ports.....	151,734	217,312	398,597	44,184	48,326	52,188	782	24,003	30,400	15,673	75,986	93,554

Port of export	Soybeans			Corn			Flaxseed			Other grain		
	1950	1955	1956	1950	1955	1956	1950	1955	1956	1950	1955	1956
	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels
Atlantic Ports												
Portland, Maine.....	---	---	---	---	---	1,306	---	---	---	---	---	---
Boston, Mass.	---	---	---	1	527	4,016	---	---	---	---	---	---
New York, N. Y.	---	90	25	2,286	3,346	1,880	851	1,525	2,516	249	1	(1)
Albany, N. Y.	---	93	35	---	7,969	3,664	351	2,649	1,504	21	128	---
Philadelphia, Pa.	---	1,661	3,672	2,543	9,198	8,072	---	73	---	40	40	---
Baltimore, Md.	---	5,800	6,242	21,406	48,134	30,726	87	---	---	(1)	14	---
Norfolk, Va.	---	7,987	4,433	252	16,035	15,852	---	---	---	---	---	---
Total.....	---	15,631	14,407	26,488	85,209	65,516	1,289	4,247	4,020	310	183	(1)
Gulf Ports												
New Orleans, La.	---	37,620	27,720	28,410	17,665	23,477	631	---	172	2	2,796	994
Baton Rouge, La.	---	2,694	6,278	---	240	6,360	---	---	297	---	---	---
Galveston, Tex.	---	---	33	4,247	101	---	302	29	1,592	20,022	16,858	16,448
Corpus Christi, Tex. ..	---	---	---	---	---	---	---	68	89	---	15,372	13,669
Houston, Tex.	---	1	---	3,802	422	39	---	---	99	21,987	20,514	10,348
Mobile, Ala.	---	3,914	10,246	---	486	783	---	---	1,064	---	468	401
Total.....	---	44,229	44,277	36,459	18,914	30,659	933	97	3,313	42,011	56,008	41,860
Pacific Ports												
Seattle, Wash.	---	(1)	---	1	1	1,689	---	(1)	---	---	---	---
Tacoma, Wash.	---	---	---	(1)	---	1,147	---	---	---	---	---	---
Portland, Oreg.	---	---	---	---	---	2,934	---	---	3	---	---	---
Vancouver, Wash.	---	---	---	---	---	392	---	---	---	---	---	---
Longview, Wash.	---	---	---	---	---	1,652	---	---	---	---	---	---
Astoria, Oreg.	---	---	---	---	---	---	---	---	---	---	---	---
Oakland, Calif.	---	---	---	---	(1)	325	---	---	---	---	420	---
San Francisco, Calif. .	---	---	---	2	1	620	---	13	---	1	469	57
Stockton, Calif.	---	---	---	---	---	964	---	---	80	---	---	---
Total.....	---	(1)	---	3	2	9,723	---	13	83	1	889	57
Grand total, above ports.....	---	59,860	58,684	62,950	104,125	105,898	2,222	4,357	7,416	42,322	59,080	41,917

[1] Less than 500 bushels.

Source: Waterborne Commerce of the United States, Department of the Army, Corps of Engineers, calendar years 1951, 1955, and 1956. Net tons have been converted to bushels. Rice is not included.

TABLE 19.--U. S. grain exports by selected areas of destination, average 1945-54

Area of destination	Wheat	Corn	Barley	Soybeans and soybean oil	Oats	Sorghum grain	Flaxseed and linseed oil[1]	Total
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
Northern, Western, and Central Europe[2]	155,118	47,211	5,846	17,351	4,514	16,424	8,920	255,384
Mediterranean[3].....	65,898	6,257	696	2,795	1,810	911	130	78,497
West Africa[4].....	2,802	1,388	---	200	---	6	---	4,396
East Africa and Near East[5].....	27,050	996	---	121	---	10,787	---	38,954
South America[6].....	17,235	203	26	348	91	2	43	17,948
Total.....	268,103	56,055	6,568	20,815	6,415	28,130	9,093	395,179

[1] Average taken for years 1950-54.
[2] Austria, Azores, Belgium-Luxembourg, Denmark, Finland, France, Germany, Iceland, Ireland (Eire), Netherlands, Norway, Poland, Portgual, Spain, Sweden, Switzerland, and the United Kingdom.
[3] Algeria, Egypt, French North Africa, Greece, Israel, Italy, Jordan, Lebanon, Malta, Trieste, Tunisia, Turkey, and Yugoslavia.
[4] Angola, Belgian Congo, British West Africa, Canary Islands, French Morocco, French West Africa, Gold Coast, Maderia Islands, Nigeria, and the Union of South Africa.
[5] Aden, British East Africa, Ceylon, India, Iran, Mozambique, Pakistan, and Saudi Arabia.
[6] Argentina, Brazil, British Guiana, British West Indies, Colombia, Dominican Republic, Paraguay, Surinam (Netherlands Guiana), Uruguay, and Venezuela.

Foreign Crops and Markets, August 19, 1957, p. 19; Statistical Bulletin No. 179, FAS; Foreign Agricultural Trade, January 1957; Feed and Grains Section, Agricultural Economics Division, AMS; Grain and Feed and Fats and Oils Division, FAS.

TABLE 20.--Navigation seasons: Montreal harbor, 1920-56

Year	Arrival of first ocean vessel	Departure of last ocean vessel	Length of navigation season
	Date	*Date*	*Days*
1920	Apr. 25	Dec. 11	231
1921	Apr. 21	Dec. 8	232
1922	Apr. 24	Dec. 2	223
1923	May 3	Dec. 1	213
1924	Apr. 24	Dec. 3	224
1925	Apr. 16	Dec. 8	237
1926	May 3	Dec. 6	218
1927	Apr. 12	Dec. 6	239
1928	Apr. 26	Dec. 9	228
1929	Apr. 20	Dec. 7	232
1930	Apr. 21	Dec. 12	236
1931	Apr. 15	Dec. 11	241
1932	Apr. 18	Dec. 7	234
1933	Apr. 14	Dec. 6	237
1934	Apr. 26	Dec. 8	227
1935	Apr. 15	Dec. 9	239
1936	Apr. 13	Dec. 11	243
1937	Apr. 19	Dec. 8	234
1938	Apr. 18	Dec. 4	231
1939	Apr. 29	Dec. 9	225
1940	Apr. 24	Dec. 5	226
1941	Apr. 18	Dec. 5	232
1942	May 2	Dec. 12	225
1943	May 24	Dec. 13	204
1944	Apr. 21	Dec. 6	229
1945	Apr. 9	Dec. 3	239
1946	Apr. 12	Dec. 18	241
1947	Apr. 21	Dec. 4	227
1948	Apr. 19	Dec. 10	236
1949	Apr. 7	Dec. 8	246
1950	Apr. 18	Dec. 7	234
1951	Apr. 13	Dec. 13	245
1952	Apr. 13	Dec. 10	242
1953	Apr. 2	Dec. 21	264
1954	March 30	Dec. 15	261
1955	Apr. 5	Dec. 16	256
1956	Apr. 2	Dec. 17	260
1957	Apr. 4		
Average	Apr. 19	Dec. 9	234.9

National Harbours Board, Montreal, Canada.

TABLE 21. --Navigation seasons: Great Lakes connecting channels and the St. Lawrence River canals

Year	St. Marys Falls Canal (Lake Superior to Lake Huron)			Welland Canal (Lake Erie to Lake Ontario)			St. Lawrence Canals (Lake Ontario to Montreal)		
	Opening of navigation	Closing of navigation	Length of navigation season	Opening of navigation	Closing of navigation	Length of navigation season	Opening of navigation	Closing of navigation	Length of navigation season
	Date	*Date*	*Days*	*Date*	*Date*	*Days*	*Date*	*Date*	*Days*
1920	Apr. 19	Dec. 26	252	Apr. 19	Dec. 15	241	May 1	Dec. 11	225
1921	do. 7	do. 24	262	do. 15	do. 19	249	Apr. 18	do. 14	241
1922	do. 17	do. 20	248	do. 17	do. 14	242	do. 19	do. 13	239
1923	May 1	do. 17	231	do. 17	do. 14	242	May 1	do. 10	224
1924	Apr. 19	do. 19	245	do. 16	do. 10	239	Apr. 22	do. 11	234
1925	Apr. 10	Dec. 16	251	Apr. 14	Dec. 17	248	Apr. 23	Dec. 11	233
1926	do. 29	do. 18	234	May 1	do. 15	229	do. 29	do. 5	221
1927	do. 13	do. 16	248	Apr. 16	do. 16	245	do. 18	do. 14	241
1928	May 3	do. 15	227	do. 16	do. 13	242	do. 16	do. 10	239
1929	Apr. 13	do. 14	246	do. 17	do. 9	237	do. 11	do. 12	246
1930	Apr. 21	Dec. 15	239	Apr. 21	Dec. 12	236	Apr. 12	Dec. 11	244
1931	do. 10	do. 15	250	do. 9	do. 17	253	do. 17	do. 12	243
1932	do. 17	do. 13	241	do. 7	do. 16	253	do. 14	do. 15	245
1933	do. 19	do. 14	240	do. 4	do. 13	254	do. 14	do. 5	236
1934	do. 29	do. 15	231	do. 17	do. 15	243	do. 18	do. 13	240
1935	Apr. 16	Dec. 16	245	Apr. 1	Dec. 20	264	Apr. 22	Dec. 15	238
1936	do. 29	do. 16	232	do. 17	do. 13	241	do. 17	do. 16	244
1937	do. 8	do. 15	252	do. 10	do. 12	247	do. 12	do. 6	239
1938	do. 12	do. 15	248	do. 11	do. 15	249	do. 16	do. 14	243
1939	do. 26	do. 15	234	do. 10	do. 16	251	do. 25	do. 11	231
1940	Apr. 11	Dec. 10	249	Apr. 22	Dec. 12	235	Apr. 17	Dec. 9	237
1941	do. 1	do. 15	259	do. 9	do. 14	250	do. 10	do. 17	252
1942	Mar. 22	do. 17	271	do. 2	do. 15	258	do. 10	do. 17	252
1943	Apr. 19	do. 15	241	do. 1	do. 18	262	do. 26	do. 17	236
1944	Mar. 31	do. 16	260	do. 1	do. 15	259	do. 14	do. 14	245
1945	Mar. 25	Dec. 15	266	Apr. 1	Dec. 15	259	Apr. 16	Dec. 4	233
1946	do. 25	do. 17	268	do. 3	do. 17	259	do. 12	do. 9	242
1947	Apr. 10	do. 15	250	do. 7	do. 15	253	do. 19	do. 11	237
1948	do. 2	do. 15	259	do. 5	do. 18	257	do. 17	do. 6	234
1949	Mar. 22	do. 15	269	Mar. 15	do. 20	280	do. 14	do. 11	242
1950	Apr. 21	Dec. 15	239	Apr. 7	Dec. 20	257	Apr. 10	Dec. 14	249
1951	do. 2	do. 16	259	Mar. 29	do. 20	266	do. 8	do. 9	246
1952	Mar. 30	do. 19	265	do. 27	do. 19	268	do. 2	do. 15	258
1953	do. 21	do. 15	270	do. 28	do. 20	268	Mar. 31	do. 14	259
1954	Apr. 11	do. 16	251	do. 28	do. 17	265	Apr. 13	do. 11	243
1955	Apr. 12	Dec. 16	250	Mar. 30	Dec. 17	263	Apr. 10	Dec. 12	247
1956	do. 4	do. 21	262	Apr. 2	do. 15	258	do. 12	do. 13	246
Average	Apr. 9	Dec. 16	250	Apr. 10	Dec. 17	252	Apr. 17	Dec. 12	241

Waterborne Commerce of the United States, Dept. of the Army, Corps of Engineers, Annual reports; Annual Reports of the Lake Carriers Association; Canal Statistics, Dominion Bureau of Statistics, Ottawa, Canada, and Canada Department of Transport, Ottawa, Canada.

TABLE 22. --Vessel particulars[1]

Particulars	Lake-ocean bulk carrier	EC 2 Liberty	Upper laker--"Thunder Bay" class
Crew	38	38	33
Length	578.0 feet	441.5 feet	647.3 feet
Breadth	72.0 do.	57.9 do.	67.0 do.
Maximum draft	30.0 do.	27.8 do.	25.5 do.
Deadweight, tons	20,350	10,800	18,000
Gross registered tons	14,600	7,191	12,000
Net registered tons	7,700	4,309	8,300
Speed at maximum draft, knots	13.5	11.0	12.5
Capacity of cargo holds for grain, cubic feet	858,000	375,000	785,000
Approximate wheat cargo capacity:			
a. At 25 1/2' draft, gross tons	15,000	8,500	16,700
b. At 25 1/2' draft, bushels	560,000	317,300	623,000
c. At full draft, gross tons	18,255	9,500	16,700
d. In holds, bushels	681,000	301,400	623,000
e. In other storage, bushels	---	53,200	---

[1] The vessel particulars will vary from ship to ship of the same class or type. The particulars are listed to give a general indication of the differences between the types of vessels.

The information regarding the lake-ocean bulk carrier is based on data furnished by the owner. Information regarding the EC 2 Liberty vessel was furnished by the Board of Engineers for Rivers and Harbors, Corps of Engineers, U. S. Army, Washington, D. C., and the U. S. Maritime Administration. The data on the Upper Laker of the "Thunder Bay" class was taken from Exhibit 200, as submitted by Canadian Steamship Lines, Ltd., to the Royal Commission on the Canadian Coasting Trade, December 1, 1955, and supplemented by information furnished by the Board of Engineers for Rivers and Harbors.

TABLE 23. --Estimated 1959 Welland Canal downbound traffic (Lake Erie to Lake Ontario) and required lockages

Commodity	Welland Canal downbound traffic 1955, not moving through the St. Lawrence canals[1]	Estimated St. Lawrence Seaway downbound traffic, 1959[2]	Estimated Welland Canal downbound traffic, 1959[3]	Estimated lockages required[4]	Percentage of available lockages[5]
	1,000 tons	*1,000 tons*	*1,000 tons*	*Lockages*	*Percent*
Coal and coke	4,235	3,288	7,523	502	17.4
Grain	3,345	10,797	14,142	943	32.7
Ore	2,512	19	2,531	169	5.8
Petroleum	1,523	281	1,804	121	4.2
Other	331	2,031	2,362	409	14.2
Total	11,946	16,416	28,362	2,144	74.3

[1] Dominion Bureau of Statistics, Canal Statistics. Net tons converted to gross tons.

[2] See (64), p. ___. For method used in estimating downbound tonnage, see table 24, footnote 1.

[3] This is the total of the 2 preceding columns. It assumes all of the estimated downbound 1959 traffic for the St. Lawrence Seaway also moves downbound through the Welland Canal.

[4] The number of lockages required assumes that all the bulk traffic will be moved in vessels carrying 15,000 gross tons of cargo per lockage. It is assumed that all "other" traffic will move in a vessel with an average load per lockage of 5,785 gross tons. This tonnage is equivalent to 60 percent of the Liberty-type vessel deadweight. See (72).

[5] The available downbound lockages total 2,885, or 84.4 percent of the theoretical maximum number of downbound lockages, totaling 3,416. The lower figure allows for delays and non-cargo lockages. See Russell, Sargent, (40), and Danielian, N.R., (13).

TABLE 24. --Traffic on the St. Lawrence Canals, 1955, and estimated traffic for 1959--gross tons

	Upbound			Downbound			Total	
	Volume	% of total commodity[1]	Lockages required[2]	Volume	% of total commodity[1]	Lockages required[2]	Volume	Lockages required[2]
1955:[3]	*1,000 tons*	*Percent*	*Number*	*1,000 tons*	*Percent*	*Number*	*1,000 tons*	*Number*
Coal and coke	7	0.49	1	1,430	99.51	96	1,437	97
Grain	2	.06	1	3,318	99.94	222	3,320	223
Ore	1,595	99.81	107	3	.19	1	1,598	108
Petroleum	1,143	86.33	77	181	13.67	12	1,324	89
Other	1,523	59.94	264	1,018	40.06	176	2,541	440
Total	4,270	41.78	450	5,950	58.22	507	10,220	957
1959 estimate:[4]								
Coal and coke	16	.49	2	3,288	99.51	220	3,304	222
Grain	7	.06	1	10,797	99.94	720	10,804	721
Ore	10,070	99.81	672	19	.19	2	10,089	674
Petroleum	1,773	86.33	119	281	13.67	19	2,054	138
Other	4,308	59.94	745	2,031	40.06	352	6,339	1,097
Total	16,174	41.78	1,539	16,416	58.22	1,313	32,590	2,852

[1] Assuming that the future upbound and downbound flow of traffic through the St. Lawrence Seaway will follow generally the existing traffic patterns through the St. Lawrence Canals, the 1959 estimated St. Lawrence Seaway traffic is apportioned between upbound and downbound movements on this basis.

[2] The number of lockages required assumes that all bulk traffic is carried in upper-laker or lake-ocean bulk carriers with an average vessel load of 15,000 gross tons per lockage. It is assumed that all "other" traffic will move in a Liberty-type vessel with an average load of 5,785 gross tons per lockage, or 60 percent of the Liberty-type vessel dead weight; see Vincent, (72).

[3] 1955 volume in net tons converted to gross tons from statistics quoted in (51).

[4] 1959 estimated volume in net tons converted to gross tons from the estimate given by the St. Lawrence Seaway Development Corporation in (64).

TABLE 25.--Grain weighing, inspection, and elevation charges, 1957[1]

Elevator location	Elevation charges per bushel of 60 pounds								
	Car to car	Car to vessel	Car to truck	Truck to truck	Truck to car	Truck to vessel	Vessel to vessel	Vessel to car	Vessel to truck
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Baltimore, Md.	---	2.00000	---	---	---	---	---	---	---
Boston, Mass.	---	---	4.25000	4.25000	---	---	---	---	4.25000
Buffalo, N. Y.	---	---	---	---	---	---	2.25000	2.25000	---
Chicago, Ill.	2.25000	2.25000	---	---	2.25000	2.25000	2.25000	2.25000	---
Duluth, Minn.	2.25000	2.25000	---	---	---	2.25000	---	---	---
Kansas City, Mo.	1.75000	1.75000	---	---	---	1.75000	---	---	---
Minneapolis, Minn.	2.25000	2.25000	---	---	2.25000	2.25000	---	---	---
Montreal, P. Q., Can.	---	---	---	---	---	---	1.36500	---	---
New Orleans, La.	---	2.25000	---	---	---	3.50000	2.25000	---	---
New York, N. Y.									
(Port Authority Term.)	---	---	---	---	---	---	2.75000	---	---
(Railroad elevator)	---	2.00000	---	---	---	---	---	---	---
Oswego, N. Y.	---	---	---	---	---	---	1.35000	1.60000	---
Portland, Oreg.	---	3.35013	---	---	---	4.10021	---	---	---
Savannah, Ga.	---	---	4.25000	4.25000	---	---	---	---	4.25000
St. Louis, Mo.	1.75000	1.75000	---	1.75000	---	1.75000	---	---	---
Toledo, Ohio	---	2.25000	---	---	---	2.25000	---	---	---
Wilmington, N. C.	---	---	4.25000	4.25000	---	---	---	---	4.25000
Country elevators	---	---	---	1.00000	2.00000	---	---	---	---
Inland waterway elevators									
(Other than those above)	2.25000	1.75000	---	---	2.25000	1.00000	---	1.75000	1.75000

Elevator location	Weighing charges per bushel of 60 pounds						Inspection charges per bushel of 60 pounds					
	Weighing in from:			Weighing out to:			Inspection in from:			Inspection out to:		
	Cars	Vessels	Trucks	Cars	Vessels	Trucks	Cars	Vessels	Trucks	Cars	Vessels	Trucks
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Baltimore, Md.	.06111	---	---	---	.03500	---	.06111	---	---	---	.06500	---
Boston, Mass.	.04722	.07500	.12500	.03333	.05500	.12500	.06944	.11500	.20833	.06944	.08000	.20833
Buffalo, N. Y.	---	.06500	---	.08333	.06500	---	---	.08000	---	.08889	.08000	---
Chicago, Ill.	.12500	.09000	.16667	.10000	.09000	---	.19444	.21000	.16667	.18056	.21000	---
Duluth, Minn.	.14444	---	.24167	.14444	.16000	---	.14444	---	.36667	.14444	.16000	---
Kansas City, Mo.	.11111	---	.12500	.11111	.07500	.12500	.11111	---	.20833	.11111	.07500	.20833
Minneapolis, Minn.	.14444	---	.24167	.14444	.16000	.24167	.14444	---	.36667	.14444	.16000	.36667
Montreal, P. Q., Can.	---	.10500	---	---	.10500	---	---	.21000	---	---	.21000	---
New Orleans, La.	.06944	.05000	.16667	---	.02500	---	.06944	.07500	.20833	---	.07500	---
New York, N. Y.												
(Port Authority Term.)	---	.06000	---	---	.06000	---	---	.06500	---	---	.10000	---
(Railroad elevator)	.05000	---	---	---	.06000	---	.07000	---	---	---	.10000	---
Oswego, N. Y.	---	.06500	---	.08333	.06500	---	---	.08000	---	.08889	.08000	---
Portland, Oreg.	.07501	---	.07501	---	.12001	---	.07501	---	.07501	---	.12001	---
Savannah, Ga.	.04722	.07500	.12500	.03333	.05500	.12500	.06944	.11500	.20833	.06944	.08000	.20833
St. Louis, Mo.	.11111	---	.12500	.11111	.05000	.12500	.11111	---	.20833	.11111	.10000	.20833
Toledo, Ohio	.05555	---	.12500	.02778	.01000	---	.16667	---	.20833	.12500	.10000	---
Wilmington, N. C.	.04722	.07500	.12500	.03333	.05500	.12500	.06944	.11500	.20833	.06944	.08000	.20833
Country elevators	---	---	.12500	.11111	---	.12500	---	---	.16667	.16667	---	.16667
Inland waterway elevators												
(Other than those above)	.05555	.05000	.04167	.05555	.05000	.04167	.15278	.10000	.10000	.11111	.10000	.10000

[1] Charges on a per bushel basis were computed by using carloads as 1,800 bushels, truckloads as 600 bushels. Vessel charges usually are published per 1,000 bushels. Generally, the above charges are assessed for the handling of private grain. Interviews with members of the grain trade indicated the elevation charges at elevators are lower, in some instances, than published charges. Allowances made for handling U. S. Government grain may vary from the above. For total grain handling charges including the above, plus shrinkage and car cooperage, and the stevedoring charges, table 27, applying to the loading and discharging of barges, see table 26.

Data obtained from Boards of Trade, appropriate state or municipal agencies, or authoritative private sources.

TABLE 26.--Estimated stevedoring charges per 1,000 bushels applying at selected ports for loading and unloading cargoes of heavy grain to and from vessels[1]

Port or port area	Barges		Upper laker		Lake-ocean bulk carrier		Liberty	
	Load	Unload	Load	Unload	Load	Unload	Load	Unload
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Duluth, Minn.	---	---	1.55	---	[2] 1.55	---	[2] 5.30-holds 30.68-'tweendecks in bins	---
Chicago, Ill.	1.80	6.50	1.10	---	1.10	---	[2] 5.30-holds 30.68-'tweendecks in bins	---
Toledo, Ohio	---	---	2.00	---	[2] 2.00	---	[2] 5.30-holds 30.68-'tweendecks in bins	---
Buffalo, N. Y.	[2] 1.80	---	---	3.56	---	---	---	---
Oswego, N. Y.	[2] 1.80	---	---	[2] 3.56	---	---	---	---
Montreal, Can.	---	---	---	5.30	1.76	---	5.30-holds 30.68-'tweendecks in bins	---
Seven Islands, Can. ..	---	---	---	[2] 5.30	[2] 1.76	---	[2] 5.30-holds 30.68-'tweendecks in bins	---
New York City, N. Y. .	---	([3])	---	---	[2] 20.89	---	20.89	---
Baltimore, Md.	---	---	---	---	[2] 10.45	---	10.45	---
New Orleans, La.	---	([3])	---	---	[2] 8.04	---	8.04-holds 24.11-'tweendecks in bins	---
Portland, Oreg.	---	---	---	---	[2] 9.38	---	9.38	---
U. S. Atlantic Coast..	---	---	---	---	---	11.25	---	20.10

[1] Charges based on straight-time stevedoring hourly rates for wheat, rye, and corn. Charges for other grains and for soybeans usually are slightly higher. This study assumes the stevedoring charges are the same for wheat, corn, barley, and soybeans.
[2] Estimated.
[3] Included in elevation charges, table 25.

TABLE 27.--Estimated grain handling charges in cents per bushel, 1957[1]

Location	Car to Car	Car to vessel	Truck to truck	Truck to car	Truck to vessel	Vessel to vessel	Vessel to car	Vessel to truck
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Baltimore, Md.	---	2.422	---	---	---	---	---	5.523
Boston, Mass.	---	---	---	---	---	---	---	5.523
Buffalo, N. Y.	---	---	---	---	---	3.292	3.595	---
Chicago, Ill.	3.328	3.069	---	3.342	3.083	3.606	3.865	---
Duluth, Minn.	3.306	3.059	---	---	3.378	---	---	---
Kansas City, Mo.	2.672	2.322	---	---	2.433	---	---	---
Minneapolis, Minn. ...	3.306	3.059	3.667	3.625	3.378	---	---	---
Montreal, P.Q., Can. .	---	---	---	---	---	2.745	---	---
New Orleans, La.	---	2.689	---	---	3.804	3.225	---	---
New York, N. Y.	---	2.480	---	---	---	3.785	---	5.523
Oswego, N. Y.	---	---	---	---	---	2.392	2.945	---
Portland, Oreg.	---	[2] 3.940	---	---	[2] 4.690	---	---	---
Savannah, Ga.	---	---	---	---	---	---	---	5.523
St. Louis, Mo.	2.672	2.322	---	---	2.433	---	---	---
Toledo, Ohio	---	2.782	---	---	2.893	---	---	---
Wilmington, N. C.	---	---	---	---	---	---	---	5.523
Country elevators	3.306	---	1.783	3.047	---	---	---	---
Inland waterway elevation (other than those above)	3.306	2.310	1.783	3.625	1.493	---	3.101	2.798

[1] Includes elevation, weighing, inspection, shrinkage, car cooperage, and the stevedoring charges applying to loading and discharging of barges, table 26. As applicable, this amounts to .00650 cents per bushel for unloading barges, and to .00180 for loading barges. Car cooperage cost was estimated to be $5.00 per car of 1,800 bushels or .27778 cents per bushel; shrinkage cost during vessel movement was estimated to be 3/4 cent per bushel, and during movement overland to be 1/5 cent per bushel. All charges are based on 33-1/3 bushels to the short ton and were assumed to apply to all grains, and soybeans, as covered in the study. For a breakdown of weighing, inspection, and elevation charges, see table 25.

[2] Includes 1 cent per bushel wharfage. This charge is assessed on all grain moving into the port, whether or not shipped out by vessel, table 59.

Grain trade, Boards of Trade, Port Authorities, State Grain Inspection Departments, The National Harbours Board of Canada, Commodity Stabilization Service, USDA, and the railroads. Generally, the above charges are assessed for the handling of private grain. Handling allowances for U. S. Government grain may vary from the above.

TABLE 28.--Estimated daily operating costs of a lake-ocean bulk carrier, 1957[1]

Costs	Foreign flag		United States flag	
	At sea	In port	At sea	In port
Daily fixed costs:[2]	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Interest	291.67	291.67	291.67	291.67
Depreciation	833.33	833.33	833.33	833.33
Subtotal	1,125.00	1,125.00	1,125.00	1,125.00
Other, excluding profit[3]	1,800.00	1,400.00	2,770.00	2,154.00
Total fixed and other costs, excluding profit.	2,925.00	2,525.00	3,895.00	3,279.00
Plus 10 percent[4]	292.50	252.50	389.50	327.90
Total fixed and other costs, including profit.	3,217.50	2,777.50	4,284.50	3,606.90

[1] Foreign-flag costs are based on data secured from the Canadian owner. U. S. flag costs are estimated by the author.

[2] Depreciation is computed on a straight-line basis assuming a vessel life of 20 years. The vessel has an estimated construction cost of $5,750,000. Interest is computed at 3 1/2 percent on one-half of the estimated construction cost, $2,875,000. To determine the daily depreciation and interest charges, the annual charges are divided by 345 days, the annual navigation season.

[3] Other costs include wages, subsistence, fuel, supplies, insurance, dues, tug and pilot service, and overhead expenses incidental to ship operation. Tolls and wharfage are not included. Foreign-flag costs are 65 percent of the estimated U. S. flag costs.

[4] The 10-percent profit factor has been added to provide a satisfactory operating ratio.

TABLE 29. --Estimated annual and daily operating costs of an EC 2 Liberty type vessel, 1955, adjusted to a 1957 daily cost basis[1]

Costs	United States flag				Foreign flag			
	At sea		In port		At sea		In port	
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Annual fixed costs:[2]								
Interest	18,000.00		18,000.00		18,000.00		18,000.00	
Depreciation	30,100.00		30,100.00		30,100.00		30,100.00	
Subtotal		48,100.00		48,100.00		48,100.00		48,100.00
Other:								
Administration and supervision	45,300.00		45,300.00					
Wages and allowances	281,700.00		281,700.00					
Subsistence	27,700.00		27,700.00					
Stores, supplies, equipment	36,500.00		36,500.00					
Maintenance and repairs	73,000.00		73,000.00					
Fuel	157,300.00		37,300.00					
Insurance[3]	63,900.00		63,900.00					
Miscellaneous	7,700.00		7,700.00					
Subtotal		693,100.00		573,100.00		[4]450,515.00		[4]372,515.00
Total annual costs, 1955, excluding profit		741,200.00		621,200.00		498,615.00		420,615.00
Plus 5 percent[5]		37,060.00		31,060.00		24,931.00		21,031.00
Total annual costs, 1957, excluding profit		778,260.00		652,260.00		523,546.00		441,646.00
Plus 10 percent[6]		77,826.00		65,226.00		52,354.00		44,164.00
Total annual costs, 1957, including profit		856,086.00		717,486.00		575,900.00		485,810.00
Cost per day, based on 345-day operating season[7]		2,481.41		2,079.67		1,669.27		1,408.14

[1] Costs are based on data secured from the Board of Engineers for Rivers and Harbors, U. S. Army, Washington, D. C.

[2] Depreciation is computed on a straight-line basis assuming a vessel life of 20 years. The vessel was purchased from the war-surplus fleet of the United States at an initial cost of $547,100, plus betterments of $54,700, or a total cost of $601,800. Interest is computed at 4 percent on one-half of the first cost, $300,900. In addition, interest is included at 5 percent on working capital of $119,000. The working capital requirement was included in the original purchase agreement.

[3] Insurance includes hull and machinery and protection and indemnity coverage.

[4] These represent 65 percent of "other costs" under United States flag operation. Although many of the individual costs are about the same under either United States or foreign flag operations, wages and allowances under foreign flag operation vary from 25 to 35 percent of wages and allowances under the United States flag.

[5] The 5 percent is added to compensate for the increased general cost level occurring between 1955 and 1957.

[6] The 10 percent profit factor has been added to provide a satisfactory operating ratio.

[7] Annual costs are allocated to a 345-day operating season, 20 days being set aside for maintenance and repairs.

TABLE 30. --Wheat and soybeans: Mileages and estimated trucking charges, in cents per bushel, between selected origins and destinations[1]

Origins	Burlington, Iowa		Chicago, Ill.		Duluth, Minn.		Kansas City, Mo.		Minneapolis, Minn.		New Orleans, La.		Peoria, Ill.		Portland, Oreg.		Savannah, Ga.		Toledo, Ohio		Wilmington, N. C.	
	Miles	Cents	Miles[2]	Cents	Miles	Cents	Miles	Cents	Miles	Cents	Miles	Cents	Miles	Cents	Miles	Cents	Miles	Cents	Miles	Cents	Miles	Cents
Burlington, Iowa...	---	---	227	14.50	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Chattanooga, Tenn..	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	384	15.70	---	---	522	20.90
Cincinnati, Ohio...	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	201	13.10	---	---
Columbus, Ohio.....	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	133	9.50	---	---
Decatur, Ill.....	---	---	177	11.80	---	---	---	---	---	---	---	---	76	6.40	---	---	---	---	357	14.60	---	---
Enid, Okla.....	---	---	834	32.75	---	---	332	13.50	---	---	770	30.40	---	---	---	---	---	---	---	---	---	---
Evansville, Ind....	---	---	292	12.10	---	---	---	---	---	---	---	---	---	---	---	---	---	---	387	15.90	---	---
Fort Dodge, Iowa...	254	10.60	379	15.50	365	15.00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Garden City, Kans..	---	---	940	36.80	960	37.50	394	16.00	---	---	1,006	39.40	---	---	---	---	---	---	---	---	---	---
Guntersville, Ala..	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	410	16.60	---	---	568	22.60
Indianapolis, Ind..	---	---	184	12.20	---	---	---	---	---	---	---	---	---	---	---	---	---	---	220	14.10	---	---
Kearney, Nebr.....	---	---	661	26.10	645	25.50	356	14.60	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Limon, Colo.....	---	---	938	36.75	917	36.00	536	21.50	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Mankato, Minn.....	---	---	---	---	232	14.75	---	---	79	6.60	---	---	---	---	---	---	---	---	---	---	---	---
Minneapolis, Minn..	---	---	---	---	153	10.50	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Minot, N. Dak.....	---	---	---	---	481	19.40	---	---	515	20.60	---	---	---	---	---	---	---	---	---	---	---	---
Omaha, Nebr.....	---	---	482	19.40	518	20.75	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Shelby, Mont.....	---	---	---	---	1,028	40.20	---	---	1,058	41.40	---	---	---	---	794	37.20	---	---	---	---	---	---
Wichita, Kans.....	---	---	733	29.00	844	33.10	220	14.10	---	---	862	33.70	---	---	---	---	---	---	---	---	---	---

[1] Mileages data were taken from the Rand McNally Road Atlas, 1956. The trucking charges were read from graphic figures 9 and 10. It is assumed that for trucking distances under 250 miles, there was no back-haul. For distances over 250 miles, it is assumed the truck had return freight. The truck capacity is 600 bushels of wheat or soybeans.
[2] Mileages are computed to Lake Calumet Harbor.

TABLE 31.--Corn: Mileages and estimated trucking charges, in cents per bushel, between selected origins and destinations[1]

Origins	Destinations																					
	Burlington, Iowa		Chicago, Ill.		Duluth, Minn.		Kansas City, Mo.		Minneapolis, Minn.		New Orleans, La.		Peoria, Ill.		Portland, Oreg.		Savannah, Ga.		Toledo, Ohio		Wilmington N. C.	
	Miles	*Cents*	*Miles*[2]	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*
Burlington, Iowa...	---	---	227	15.53	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Chattanooga, Tenn..	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	384	16.81	---	---	522	22.38
Cincinnati, Ohio...	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	201	14.03	---	---
Columbus, Ohio.....	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	133	10.17	---	---
Decatur, Ill.....	---	---	177	12.64	---	---	---	---	---	---	---	---	76	6.85	---	---	---	---	357	15.64	---	---
Enid, Okla.....	---	---	834	35.08	---	---	332	14.46	---	---	770	32.56	---	---	---	---	---	---	---	---	---	---
Evansville, Ind....	---	---	292	12.96	---	---	---	---	---	---	---	---	---	---	---	---	---	---	387	17.03	---	---
Fort Dodge, Iowa...	254	11.35	379	16.60	365	16.06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Garden City, Kans..	---	---	940	39.41	960	40.16	394	17.14	---	---	1,006	42.20	---	---	---	---	---	---	---	---	---	---
Guntersville, Ala..	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	410	17.78	---	---	568	24.20
Indianapolis, Ind..	---	---	184	13.07	---	---	---	---	---	---	---	---	---	---	---	---	---	---	220	15.10	---	---
Kearney, Nebr.....	---	---	661	27.95	645	27.31	356	15.64	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Limon, Colo.....	---	---	938	39.36	917	38.56	536	23.03	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Mankato, Minn.....	---	---	---	---	232	15.80	---	---	79	7.07	---	---	---	---	---	---	---	---	---	---	---	---
Minneapolis, Minn..	---	---	---	---	153	11.25	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Minot, N. Dak.....	---	---	---	---	481	20.78	---	---	515	22.06	---	---	---	---	---	---	---	---	---	---	---	---
Omaha, Nebr.....	---	---	482	20.78	518	22.22	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Shelby, Mont.....	---	---	---	---	1,028	43.05	---	---	1,058	44.34	---	---	---	---	794	39.84	---	---	---	---	---	---
Wichita, Kans.....	---	---	733	31.06	844	35.45	220	15.10	---	---	862	36.09	---	---	---	---	---	---	---	---	---	---

[1] Mileages data from Rand McNally Road Atlas, 1956. It requires 46.5 cu. ft. of storage for a gross ton of wheat or soybeans. For corn, 49.8 cu. ft. of storage is required per gross ton, or 107.1 percent of that required for wheat or soybeans. The charges for trucking wheat or soybeans, table 30, were multiplied by 107.1 percent to determine the charges below.

[2] Mileages are computed to Lake Calumet Harbor.

TABLE 32. --Barley: Mileages and estimated trucking charges, in cents per bushel, between selected origins and destinations[1]

Origins	Destinations																					
	Burlington, Iowa		Chicago, Ill.		Duluth, Minn.		Kansas City, Mo.		Minneapolis, Minn.		New Orleans, La.		Peoria, Ill.		Portland, Oreg.		Savannah, Ga.		Toledo, Ohio		Wilmington N. C.	
	Miles	*Cents*	*Miles*[2]	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*
Burlington, Iowa...	---	---	227	18.11	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Chattanooga, Tenn..	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	384	19.61	---	---	522	26.10
Cincinnati, Ohio...	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	201	16.36	---	---
Columbus, Ohio.....	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	133	11.87	---	---
Decatur, Ill.....	---	---	177	14.74	---	---	---	---	---	---	---	---	76	7.99	---	---	---	---	357	18.24	---	---
Enid, Okla.....	---	---	834	40.90	---	---	332	16.86	---	---	770	37.97	---	---	---	---	---	---	---	---	---	---
Evansville, Ind....	---	---	292	15.11	---	---	---	---	---	---	---	---	---	---	---	---	---	---	387	19.86	---	---
Fort Dodge, Iowa...	254	13.24	379	19.36	365	18.73	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Garden City, Kans..	---	---	940	45.96	960	46.84	394	19.98	---	---	1,006	49.21	---	---	---	---	---	---	---	---	---	---
Guntersville, Ala..	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	410	20.73	---	---	568	28.23
Indianapolis, Ind..	---	---	184	15.24	---	---	---	---	---	---	---	---	---	---	---	---	---	---	220	17.61	---	---
Kearney, Nebr.....	---	---	661	32.60	645	31.85	356	18.24	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Limon, Colo.....	---	---	938	45.90	917	44.96	536	26.85	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Mankato, Minn.....	---	---	---	---	232	18.42	---	---	79	8.24	---	---	---	---	---	---	---	---	---	---	---	---
Minneapolis, Minn..	---	---	---	---	153	13.11	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Minot, N. Dak.....	---	---	---	---	481	24.23	---	---	515	25.73	---	---	---	---	---	---	---	---	---	---	---	---
Omaha, Nebr.....	---	---	482	24.23	518	25.92	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Shelby, Mont.....	---	---	---	---	1,028	50.21	---	---	1,058	51.71	---	---	---	---	794	46.46	---	---	---	---	---	---
Wichita, Kans.....	---	---	733	36.22	844	41.34	220	17.61	---	---	862	42.09	---	---	---	---	---	---	---	---	---	---

[1] Mileages data from Rand McNally Road Atlas, 1956. It requires 46.5 cu. ft. of storage for a gross ton of wheat or soybeans, table 30. For barley, 58.1 cu. ft. of storage is required per gross ton, or 124.9 percent of that required for wheat or soybeans. The charges for trucking wheat or soybeans, table 30, were multiplied by 124.9 percent to determine the charges below.

[2] Mileages are computed to Lake Calumet Harbor.

TABLE 33. --Grain trucking charges, 1957

Revenue miles hauling grain[1]	Revenue per bushel of 60 pounds[2]	Revenue miles hauling grain[1]	Revenue per bushel of 60 pounds[2]	Revenue miles hauling grain[1]	Revenue per bushel of 60 pounds[2]
Miles	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*
5	2.00	70	7.00	191	7.50
8	2.50	72	5.18	200	13.80
8	2.25	72	8.00	201	10.45
8	2.00	78	4.35	220	11.45
11	3.00	81	6.00	231	12.00
11	2.50	82	7.00	232	12.05
14	2.50	88	7.00	257	10.07
15	3.50	92	8.00	272	11.42
15	2.75	92	7.00	303	12.60
15	2.50	93	10.00	306	12.00
17	3.00	93	8.00	310	14.42
19	2.50	93	4.95	316	12.60
19	3.00	95	3.73	320	14.40
20	3.50	99	8.00	335	12.60
22	4.00	100	8.00	348	13.20
25	4.00	100	8.00	350	13.20
25	3.50	100	9.00	354	13.20
28	4.00	102	7.65	373	14.61
30	4.25	103	8.00	373	23.10
30	3.75	103	10.00	380	19.45
35	5.00	105	5.70	515	20.17
35	4.00	106	8.00	515	21.90
35	4.50	106	10.00	539	21.11
35	4.00	107	8.00	539	23.10
40	4.50	107	6.00	597	24.72
40	4.00	112	6.89	602	25.46
42	4.50	117	6.30	713	36.00
45	5.00	119	8.00	790	37.20
45	4.50	119	6.00	794	37.20
49	5.50	120	9.30	798	37.20
49	5.00	123	10.00	897	38.40
49	4.50	131	7.00	900	38.40
50	5.00	133	7.10	930	40.50
50	4.50	137	10.00	930	37.20
51	6.00	152	7.95	930	36.43
54	6.00	154	10.00	940	38.40
55	6.00	160	12.60	952	37.20
55	5.50	167	8.80	952	37.29
55	5.00	170	8.95	1,012	41.40
58	7.50	171	9.00	1,012	37.20
60	6.50	176	9.25	1,058	41.40
60	6.00	190	9.95	1,058	37.20
69	6.00	191	8.00	1,058	41.44

[1] For distances under 250 miles sources indicate return hauls, if any, were sporadic and of limited volume. For distances over 250 miles grain is either a back-haul commodity or the one-way haul of a round trip freight movement. For graphic presentations, see figures 9 and 10.

[2] Applies to wheat and soybeans.

Different rates are shown for identical mileages and the same rates for different mileages since the above represents quotations from numerous sources, i.e.; grain merchandising companies, truckers, Boards of Trade, and State regulatory agencies. They cover charges made for the transportation of grain into the following terminal markets: Minneapolis-St. Paul, Duluth-Superior, Chicago, Toledo, and St. Louis. For distances under 250 miles, movements to and from inland waterway elevators are included. For distances over 250 miles, movements into the Portland, Oreg. terminal market and movements from the Midwest to the Southeast are also included.

TABLE 34.--Railroad charges and estimated railroad costs in cents per bushel for representative domestic movements of wheat, corn, barley, and soybeans, July 15, 1957[1]

Movement and commodity	Rate	Cost	
		Out-of-pocket	Fully-distributed
To Baltimore, Md. from:			
Buffalo, N. Y.:	*Cents*	*Cents*	*Cents*
Wheat	22.95	10.78	15.89
Corn	21.57	10.18	14.96
Barley	18.81	9.18	13.28
Soybeans	22.95	10.87	15.98
Chicago, Ill.:			
Wheat	29.10	16.74	25.10
Corn	27.16	15.70	23.50
Barley	23.28	14.14	20.83
Soybeans	29.10	16.78	25.14
Duluth, Minn.:			
Wheat	44.10	21.16	34.21
Corn	41.16	21.18	33.36
Barley	35.28	17.93	28.37
Soybeans	44.10	22.37	35.42
Kansas City, Mo.:			
Wheat	47.40	20.41	32.96
Corn	44.24	20.43	32.15
Barley	37.92	17.29	27.34
Soybeans	47.40	21.58	34.13
Minneapolis, Minn.:			
Wheat	44.10	20.64	33.35
Corn	41.16	20.66	32.52
Barley	35.28	17.49	27.66
Soybeans	44.10	21.82	34.53
Toledo, Ohio:			
Wheat	29.10	13.10	19.50
Corn	27.16	12.37	18.35
Barley	23.28	11.15	16.27
Soybeans	29.10	13.21	19.62
To Boston, Mass. from:			
Buffalo, N. Y.:			
Wheat	26.25	11.92	17.68
Corn	24.65	11.26	16.63
Barley	21.45	10.15	14.75
Soybeans	26.25	12.02	17.80
Oswego, N. Y.:			
Wheat	24.75	10.13	14.89
Corn	23.25	9.57	14.01
Barley	20.25	8.64	12.44
Soybeans	24.75	10.21	15.00
Chicago, Ill.:			
Wheat	32.10	19.95	30.15
Corn	29.96	18.83	28.35
Barley	25.68	16.95	25.11
Soybeans	32.10	20.14	30.34
Toledo, Ohio:			
Wheat	32.10	16.50	24.79
Corn	29.96	15.58	23.27
Barley	25.68	14.03	19.45
Soybeans	31.10	16.65	24.94
To New York, N. Y. from:			
Buffalo, N. Y.:			
Wheat	22.95	10.71	15.79
Corn	21.57	10.12	14.86
Barley	18.81	9.12	13.19
Soybeans	22.95	10.80	15.88
Chicago, Ill.:			
Wheat	30.90	18.61	28.07
Corn	28.84	17.57	26.40
Barley	24.72	15.82	23.39
Soybeans	30.90	18.79	28.25
Duluth, Minn.:			
Wheat	45.90	21.32	34.48
Corn	42.84	21.34	33.62
Barley	36.72	18.06	28.59
Soybeans	45.90	22.54	35.70
Kansas City, Mo.:			
Wheat	49.20	22.57	36.54
Corn	45.92	22.58	35.63
Barley	39.36	19.12	30.30
Soybeans	49.20	23.86	37.83
To New York, N. Y. from--Con.			
Minneapolis, Minn.:			
Wheat	45.90	21.10	34.12
Corn	42.84	21.12	33.27
Barley	36.72	17.88	28.29
Soybeans	45.90	22.31	35.32
Oswego, N. Y.:			
Wheat	21.15	9.88	14.49
Corn	19.89	9.33	13.64
Barley	17.37	8.42	12.11
Soybeans	21.15	9.95	14.57
Toledo, Ohio:			
Wheat	30.90	15.03	22.51
Corn	28.84	14.20	21.17
Barley	24.72	12.79	18.77
Soybeans	30.90	15.17	22.64
To Savannah, Ga. from:			
Buffalo, N. Y.:			
Wheat	70.20	19.82	32.09
Corn	65.52	19.16	30.60
Barley	56.16	17.05	26.87
Soybeans	70.20	20.24	32.51
Chattanooga, Tenn.:			
Wheat	39.90	8.26	14.25
Corn	37.24	7.98	13.29
Barley	31.92	6.34	10.89
Soybeans	39.90	8.62	14.31
Chicago, Ill.:			
Wheat	54.30	18.39	29.70
Corn	50.68	17.78	28.34
Barley	43.44	15.83	24.88
Soybeans	54.30	18.78	30.09
Cincinnati, Ohio:			
Wheat	37.50	12.69	21.90
Corn	35.00	12.24	20.84
Barley	30.00	9.75	17.12
Soybeans	37.50	13.23	22.44
Duluth, Minn.:			
Wheat	67.50	22.25	39.11
Corn	63.00	22.84	38.57
Barley	54.00	19.35	32.83
Soybeans	67.50	23.11	39.96
Evansville, Ind.:			
Wheat	41.40	12.58	21.70
Corn	38.64	12.14	20.65
Barley	33.12	9.67	16.96
Soybeans	41.40	13.12	22.24
Guntersville, Ala.:			
Wheat	43.50	8.57	14.50
Corn	40.60	8.28	13.82
Barley	34.80	6.57	11.32
Soybeans	43.50	8.94	14.87
Kansas City, Mo.:			
Wheat	70.50	19.07	33.40
Corn	65.80	19.60	32.98
Barley	56.40	16.60	28.07
Soybeans	70.50	19.81	34.14
Memphis, Tenn.:			
Wheat	36.90	12.96	22.38
Corn	34.44	12.50	21.29
Barley	29.52	9.96	17.50
Soybeans	36.90	13.51	22.93
Minneapolis, Minn.:			
Wheat	67.50	21.14	36.70
Corn	63.00	21.71	36.62
Barley	54.00	18.39	31.17
Soybeans	67.50	21.95	37.93
Toledo, Ohio:			
Wheat	53.70	16.93	27.27
Corn	50.12	16.37	26.02
Barley	42.96	14.58	22.85
Soybeans	53.70	17.29	27.62

See footnote at end of table.

Continued

TABLE 34. --Railroad charges and estimated railroad costs in cents per bushel for representative domestic movements of wheat, corn, barley, and soybeans, July 15, 1957[1]--Continued

Movement and commodity	Rate	Cost	
		Out-of-pocket	Fully-distributed
To Wilmington, N. C. from:			
Buffalo, N. Y.:	*Cents*	*Cents*	*Cents*
Wheat	48.30	16.21	26.06
Corn	45.08	15.67	24.87
Barley	38.64	13.96	21.84
Soybeans	48.30	16.55	26.41
Chattanooga, Tenn.:			
Wheat	49.20	10.52	18.00
Corn	45.92	10.15	17.14
Barley	39.36	8.07	14.06
Soybeans	49.20	10.97	18.45
Chicago, Ill.:			
Wheat	56.40	18.42	29.75
Corn	52.64	17.81	28.38
Barley	45.12	15.85	24.92
Soybeans	56.40	18.81	30.14
Cincinnati, Ohio:			
Wheat	39.60	12.92	22.30
Corn	36.96	12.46	21.22
Barley	31.68	9.93	17.43
Soybeans	39.60	13.46	22.85
Duluth, Minn.:			
Wheat	69.60	22.28	39.17
Corn	64.96	22.88	38.65
Barley	55.68	19.38	32.89
Soybeans	69.60	23.14	40.04
Evansville, Ind.:			
Wheat	43.50	14.53	25.19
Corn	40.60	14.01	23.96
Barley	34.80	11.17	19.70
Soybeans	43.50	15.14	25.81
To Wilmington, N. C. from--Con.			
Guntersville, Ala.:			
Wheat	55.20	12.14	20.92
Corn	51.52	11.72	19.91
Barley	44.16	9.33	16.35
Soybeans	55.20	12.66	21.64
Kansas City, Mo.:			
Wheat	72.60	20.71	36.35
Corn	67.76	21.27	35.87
Barley	58.08	18.02	30.53
Soybeans	72.60	21.51	37.15
Memphis, Tenn.:			
Wheat	39.00	15.33	26.63
Corn	36.40	14.78	25.32
Barley	31.20	11.79	20.83
Soybeans	39.00	15.98	27.28
Minneapolis, Minn.:			
Wheat	69.60	21.54	37.84
Corn	64.96	22.12	37.33
Barley	55.68	18.73	31.77
Soybeans	69.60	22.37	38.66
Toledo, Ohio:			
Wheat	55.80	16.06	25.82
Corn	52.08	15.53	24.63
Barley	44.64	13.83	21.63
Soybeans	55.80	16.40	26.15

[1] Railroad charges are from published tariffs. The data were furnished by the Commodity Stabilization Service, USDA, and by the railroads. The following weights per bushel were used: Wheat and soybeans, 60 pounds; corn, 56 pounds; and barley, 48 pounds. Railroad costs are based on information furnished by the Interstate Commerce Commission. For basic railroad cost data, see table 37. For examples of computations, see table 36.

TABLE 35.--Railroad charges and estimated railroad costs (in cents per bushel) for representative export movements of wheat, corn, barley, and soybeans, July 15, 1957[1]

Movement and commodity	Rate	Cost	
		Out-of-pocket	Fully-distributed
To Baltimore, Md. from:			
Buffalo, N. Y.:	*Cents*	*Cents*	*Cents*
Wheat	14.25	10.78	15.89
Corn	13.45	10.18	14.96
Barley	13.53	9.18	13.28
Soybeans	14.25	10.87	15.98
Burlington, Iowa:			
Wheat	36.90	17.54	28.21
Corn	34.44	17.57	27.52
Barley	29.52	14.87	23.40
Soybeans	43.80	18.55	29.22
Chicago, Ill.:			
Wheat	18.90	16.74	25.10
Corn	17.64	15.70	23.50
Barley	15.12	14.14	20.83
Soybeans	25.80	16.78	25.14
Cincinnati, Ohio:			
Wheat	25.80	13.29	19.81
Corn	24.08	12.55	18.63
Barley	20.64	11.31	16.52
Soybeans	30.00	13.41	19.92
Columbus, Ohio:			
Wheat	25.80	11.99	17.77
Corn	24.08	11.32	16.72
Barley	20.64	10.20	14.84
Soybeans	27.00	12.09	17.87
Decatur, Ill.:			
Wheat	18.90	17.21	25.89
Corn	17.64	16.25	24.35
Barley	15.12	14.63	21.58
Soybeans	25.80	17.36	26.05
Duluth, Minn.:			
Wheat	33.90	21.16	34.21
Corn	31.64	21.18	33.36
Barley	27.12	17.93	28.37
Soybeans	40.80	22.37	35.42
Evansville, Ind.:			
Wheat	27.90	16.95	25.49
Corn	26.04	16.00	23.97
Barley	22.32	14.41	19.64
Soybeans	40.20	17.11	25.65
Fort Dodge, Iowa:			
Wheat	44.40	20.27	32.75
Corn	41.44	20.30	31.94
Barley	35.52	17.18	27.16
Soybeans	51.30	21.44	33.91
Indianapolis, Ind.:			
Wheat	25.80	14.74	22.06
Corn	24.08	13.92	20.75
Barley	20.64	12.54	18.39
Soybeans	27.00	14.87	22.19
Kansas City, Mo.:			
Wheat	37.20	20.41	32.96
Corn	34.72	20.43	32.15
Barley	29.76	17.29	27.34
Soybeans	44.10	21.58	34.13
Kearney, Nebr.:			
Wheat	54.00	24.26	39.35
Corn	50.40	24.27	38.36
Barley	43.20	20.55	32.62
Soybeans	60.90	25.64	40.74
Minneapolis, Minn.:			
Wheat	33.90	20.64	33.35
Corn	31.64	20.66	32.52
Barley	27.12	17.49	27.66
Soybeans	40.80	21.82	34.53
Omaha, Nebr.:			
Wheat	37.20	21.65	35.03
Corn	34.72	21.67	34.15
Barley	29.76	18.35	29.04
Soybeans	44.10	22.89	36.27
Oswego, N. Y.:			
Wheat	13.35	11.05	16.32
Corn	12.61	10.44	15.36
Barley	12.81	9.41	13.63
Soybeans	13.35	11.14	16.41
Peoria, Ill.:			
Wheat	18.90	17.95	27.04
Corn	17.64	16.95	25.44
Barley	15.12	15.25	22.53
Soybeans	25.80	18.11	27.21
St. Louis, Mo.:			
Wheat	23.10	18.62	28.10
Corn	21.56	17.58	26.43
Barley	18.48	15.83	23.40
Soybeans	30.00	18.80	28.27
Toledo, Ohio:			
Wheat	25.80	13.10	19.50
Corn	24.08	12.37	18.35
Barley	20.64	11.15	16.27
Soybeans	27.00	13.21	19.62

Movement and commodity	Rate	Cost	
		Out-of-pocket	Fully-distributed
To Chicago, Ill. from:			
Burlington, Iowa:	*Cents*	*Cents*	*Cents*
Wheat	18.00	6.87	10.52
Corn	16.80	6.94	10.35
Barley	14.40	5.87	8.79
Soybeans	18.00	7.29	10.94
Decatur, Ill.:			
Wheat	14.40	6.95	9.95
Corn	13.44	6.57	9.37
Barley	11.52	5.95	8.35
Soybeans	14.40	7.01	10.00
Enid, Okla.:			
Wheat	39.60	14.55	23.26
Corn	36.96	14.59	22.71
Barley	31.68	12.35	19.32
Soybeans	39.60	15.40	24.10
Indianapolis, Ind.:			
Wheat	18.90	7.18	10.31
Corn	17.64	6.79	9.70
Barley	15.12	6.14	8.64
Soybeans	18.90	7.24	10.36
Kansas City, Mo.:			
Wheat	18.30	10.22	16.07
Corn	17.08	10.28	15.74
Barley	14.64	8.69	13.37
Soybeans	18.30	10.82	16.88
Kearney, Nebr.:			
Wheat	35.10	13.29	21.17
Corn	32.76	13.34	20.69
Barley	28.08	11.28	17.59
Soybeans	35.10	14.07	21.94
Limon, Colo.:			
Wheat	48.30	17.64	28.37
Corn	45.08	17.67	27.69
Barley	38.64	14.96	23.54
Omaha, Nebr.:			
Wheat	18.30	10.78	17.01
Corn	17.08	10.84	16.65
Barley	14.64	9.17	14.15
Soybeans	18.30	11.42	17.65
Peoria, Ill.:			
Wheat	14.40	6.62	9.43
Corn	13.44	6.26	8.88
Barley	11.52	5.66	7.91
Soybeans	14.40	6.66	9.47
St. Louis, Mo.:			
Wheat	18.00	8.71	12.68
Corn	16.80	8.23	11.94
Barley	14.40	7.44	10.61
Soybeans	18.00	8.78	12.76
Wichita, Kans.:			
Wheat	37.20	13.10	20.86
Corn	34.72	13.15	20.38
Barley	29.76	11.13	17.33
Soybeans	37.20	13.87	21.62
To Duluth, Minn. from:			
Fort Dodge, Iowa:			
Wheat	24.60	8.72	14.10
Corn	22.96	8.34	13.36
Barley	19.68	7.44	11.74
Soybeans	24.60	9.01	14.39
Mankato, Minn.:			
Wheat	18.30	7.06	11.20
Corn	17.08	6.76	10.63
Barley	14.64	6.04	9.36
Soybeans	18.30	7.30	11.44
Minneapolis, Minn.:			
Wheat	6.00	6.05	9.45
Corn	5.60	5.80	8.97
Barley	4.80	5.19	7.91
Soybeans	6.00	6.26	9.66
Minot, N. Dak.:			
Wheat	29.10	10.60	17.38
Corn	27.16	10.12	16.45
Barley	23.28	9.01	14.44
Soybeans	29.10	10.94	17.72
Shelby, Mont.:			
Wheat	48.60	17.88	30.07
Barley	38.88	15.14	24.90
To Kansas City, Mo. from:			
Enid, Okla.:			
Wheat	21.30	7.93	12.72
Corn	19.88	7.59	12.06
Barley	17.04	6.77	10.60
Soybeans	21.30	8.20	12.99
Garden City, Kans.:			
Wheat	24.60	9.22	14.98
Corn	22.96	8.82	14.19
Barley	19.68	7.86	12.46
Soybeans	24.60	9.53	15.28

See footnotes at end of table.

TABLE 35. --Railroad charges and estimated railroad costs (in cents per bushel) for representative export movements of wheat, corn, barley, and soybeans, July 15, 1957--Continued

Movement and commodity	Rate	Cost	
		Out-of-pocket	Fully-distributed
	Cents	*Cents*	*Cents*
To Duluth, Minn. from:--Con.			
Kearney, Nebr.:			
Wheat	16.80	8.72	14.10
Corn	15.68	8.34	13.36
Barley	13.44	7.44	11.74
Soybeans	16.80	9.01	14.39
Limon, Colo.:			
Wheat	30.00	11.21	18.44
Corn	28.00	10.71	17.46
Barley	24.00	9.53	15.32
Wichita, Kans.:			
Wheat	18.90	6.72	10.61
Corn	17.64	6.43	10.07
Barley	15.12	5.75	8.87
Soybeans	18.90	6.95	10.84
To Minneapolis, Minn. from:			
Mankato, Minn.:			
Wheat	18.30	5.92	9.21
Corn	17.08	7.10	8.75
Barley	14.64	5.07	7.71
Soybeans	18.30	6.12	9.36
Minot, N. Dak.:			
Wheat	29.10	11.18	18.40
Corn	27.16	10.68	17.42
Barley	23.28	9.51	15.28
Soybeans	29.10	11.55	18.76
Shelby, Mont.:			
Wheat	48.60	17.13	28.77
Barley	38.88	14.52	23.83
To New Orleans, La. from:			
Burlington, Iowa:			
Wheat	32.10	15.96	26.72
Corn	29.96	15.23	25.28
Barley	25.68	13.53	22.14
Soybeans	32.10	16.47	27.23
Chicago, Ill:			
Wheat	18.90	16.90	27.22
Corn	17.64	16.34	25.97
Barley	15.12	14.55	22.80
Soybeans	27.00	17.26	27.58
Cincinnati, Ohio:.			
Wheat	14.40	14.38	24.92
Corn	13.44	13.86	23.70
Barley	11.52	11.05	19.49
Soybeans	14.40	14.98	25.53
Columbus, Ohio:			
Wheat	29.70	17.78	28.67
Corn	27.72	17.18	27.36
Barley	23.76	15.30	24.02
Soybeans	29.70	18.15	29.05
Decatur, Ill.:			
Wheat	20.70	14.78	23.68
Corn	19.32	14.29	22.60
Barley	16.56	12.73	19.85
Soybeans	28.80	15.09	23.99
Duluth, Minn.:			
Wheat	33.60	21.88	37.05
Corn	31.36	20.87	35.03
Barley	26.88	18.51	30.65
Soybeans	36.90	22.57	37.74
Enid, Okla.:			
Wheat	39.90	14.34	23.90
Corn	37.24	13.69	22.61
Barley	31.92	12.17	19.81
Soybeans	39.90	14.80	24.36
Evansville, Ind.:			
Wheat	14.40	12.16	20.95
Corn	13.44	11.73	19.93
Barley	11.52	9.34	16.37
Soybeans	14.40	12.68	21.46
Fort Dodge, Iowa:			
Wheat	37.20	18.92	31.90
Corn	34.72	18.05	30.16
Barley	29.76	16.03	26.40
Soybeans	37.20	19.52	32.50
Garden City, Kans.:			
Wheat	46.80	18.00	30.29
Corn	43.68	17.18	28.64
Barley	37.44	15.25	25.08
Soybeans	46.80	18.57	30.86
Kansas City, Mo.:			
Wheat	25.50	15.82	26.49
Corn	23.80	15.10	25.05
Barley	20.40	13.42	21.95
Soybeans	25.50	16.27	26.94
Kearney, Nebr.:			
Wheat	44.40	18.85	31.76
Corn	41.44	17.98	30.03
Barley	35.52	15.96	26.29
Soybeans	44.40	19.44	32.36

Movement and commodity	Rate	Cost	
		Out-of-pocket	Fully-distributed
	Cents	*Cents*	*Cents*
To New Orleans, La. from:--Con.			
Limon, Colo.:			
Wheat	55.20	21.20	35.86
Corn	51.52	20.22	33.91
Barley	44.16	17.94	29.67
Memphis, Tenn.:			
Wheat	14.40	8.18	13.80
Corn	13.44	7.90	13.15
Barley	11.52	6.27	10.77
Soybeans	14.40	8.53	14.15
Minneapolis, Minn.:			
Wheat	33.60	20.47	34.58
Corn	31.36	19.52	32.70
Barley	26.88	17.32	28.62
Soybeans	36.90	21.11	35.23
Omaha, Nebr.:			
Wheat	27.60	18.31	30.83
Corn	25.76	17.47	29.15
Barley	22.08	15.51	25.53
Soybeans	27.60	18.89	31.42
Peoria, Ill.:			
Wheat	20.70	15.85	25.46
Corn	18.48	15.32	24.30
Barley	16.56	13.65	21.34
Soybeans	28.80	16.18	25.79
St. Louis, Mo.:			
Wheat	14.40	13.32	22.12
Corn	13.44	12.72	20.93
Barley	11.52	11.31	18.35
Soybeans	14.40	13.75	22.55
Toledo, Ohio:			
Wheat	30.60	18.88	30.51
Corn	28.56	18.24	29.10
Barley	24.48	16.24	25.55
Soybeans	30.60	19.27	30.91
Wichita, Kans.:			
Wheat	40.50	15.44	25.82
Corn	37.80	14.74	24.43
Barley	32.40	13.09	21.40
Soybeans	40.50	15.94	26.32
To New York, N. Y. from:			
Buffalo, N. Y.:			
Wheat	14.25	10.71	15.79
Corn	13.45	10.12	14.86
Barley	13.53	9.12	13.19
Soybeans	14.25	10.80	15.88
Burlington, Iowa:			
Wheat	37.80	19.45	31.37
Corn	35.28	19.48	30.61
Barley	30.24	16.49	26.03
Soybeans	44.70	20.57	32.50
Chicago, Ill.:			
Wheat	19.80	18.61	28.07
Corn	18.48	17.57	26.40
Barley	15.84	15.82	23.39
Soybeans	26.70	18.79	28.25
Cincinnati, Ohio:			
Wheat	26.70	15.34	23.91
Corn	24.92	15.05	22.49
Barley	21.36	13.55	19.93
Soybeans	30.90	16.08	24.06
Columbus, Ohio:			
Wheat	26.70	14.27	21.33
Corn	24.92	13.48	20.06
Barley	21.36	12.14	17.79
Soybeans	27.90	14.40	21.46
Decatur, Ill.:			
Wheat	19.80	19.61	29.63
Corn	18.48	18.51	27.86
Barley	15.84	16.66	24.67
Soybeans	26.70	19.79	29.81
Duluth, Minn.:			
Wheat	34.80	21.32	34.48
Corn	32.48	21.34	33.62
Barley	27.84	18.06	28.59
Soybeans	41.70	22.54	35.70
Evansville, Ind.:			
Wheat	28.80	19.59	29.60
Corn	26.88	18.50	27.84
Barley	23.04	16.65	24.65
Soybeans	41.10	19.78	29.78
Fort Dodge, Iowa:			
Wheat	45.30	21.95	35.53
Corn	42.28	21.97	34.65
Barley	36.24	18.60	29.46
Soybeans	52.20	23.21	36.79
Indianapolis, Ind.:			
Wheat	26.70	17.14	25.79
Corn	24.92	16.18	24.26
Barley	21.36	14.57	21.49
Soybeans	32.70	17.30	25.95

See footnotes at end of table.

TABLE 35. --Railroad charges and estimated railroad costs (in cents per bushel) for representative export movements of wheat, corn, barley, and soybeans, July 15, 1957[1]--Continued

Movement and commodity	Rate	Cost	
		Out-of-pocket	Fully-distributed
To New York, N. Y. from:--Con.			
Kansas City, Mo.:	*Cents*	*Cents*	*Cents*
Wheat	38.10	22.57	36.54
Corn	35.56	22.58	35.63
Barley	30.48	19.12	30.30
Soybeans	45.00	23.86	37.83
Kearney, Nebr.:			
Wheat	54.90	26.16	42.50
Corn	51.24	26.16	41.42
Barley	43.92	22.15	35.22
Soybeans	61.80	27.65	43.99
Minneapolis, Minn.:			
Wheat	34.80	21.10	34.12
Corn	32.48	21.12	33.27
Barley	27.84	17.88	28.29
Soybeans	41.70	22.31	35.32
Omaha, Nebr.:			
Wheat	38.10	23.56	38.20
Corn	35.56	23.58	37.23
Barley	30.48	19.96	31.67
Soybeans	45.00	24.91	39.55
Oswego, N. Y.:			
Wheat	13.35	9.88	14.49
Corn	12.61	9.33	13.64
Barley	12.81	8.42	12.11
Soybeans	13.35	9.95	14.57
Peoria, Ill.:			
Wheat	19.80	20.19	30.53
Corn	18.48	19.06	28.71
Barley	15.84	17.15	25.42
Soybeans	26.70	20.38	30.72
St. Louis, Mo.:			
Wheat	24.00	21.03	31.83
Corn	22.40	19.85	29.93
Barley	19.20	17.86	26.51
Soybeans	30.90	21.23	32.03
To New York, N. Y. from:--Con.			
Toledo, Ohio:	*Cents*	*Cents*	*Cents*
Wheat	26.70	15.03	22.51
Corn	24.92	14.20	21.17
Barley	21.36	12.79	18.77
Soybeans	27.90	15.17	22.64
To Portland, Oreg. from:			
Shelby, Mont.:			
Wheat	40.20	14.92	25.07
Barley	32.16	12.66	20.66
To Toledo, Ohio from:			
Cincinnati, Ohio:			
Wheat	16.20	7.44	10.71
Corn	15.12	7.03	10.08
Barley	12.96	6.36	8.97
Soybeans	16.20	7.49	10.76
Columbus, Ohio:			
Wheat	15.30	6.28	8.90
Corn	14.28	5.94	8.38
Barley	12.24	5.38	7.47
Soybeans	15.30	6.32	8.95
Decatur, Ill.:			
Wheat	24.00	9.44	13.81
Corn	22.40	8.92	13.00
Barley	19.20	8.05	11.55
Soybeans	24.00	9.52	13.89
Evansville, Ind.:			
Wheat	27.90	10.37	15.27
Corn	26.04	9.80	14.36
Barley	22.32	8.84	12.75
Soybeans	27.90	10.46	15.35
Indianapolis, Ind.:			
Wheat	18.00	7.67	11.06
Corn	16.80	7.25	10.41
Barley	14.40	6.55	9.26
Soybeans	18.00	7.72	11.11

[1] Railroad charges are based on published tariffs. The data were furnished by the Commodity Stabilization Service, USDA, and by the railroads. Railroad costs are based on information furnished by the Interstate Commerce Commission. For basic cost data see table 37. For examples of computations, see table 36.

TABLE 36. --Estimated railroad costs between selected origins and destinations, 1957[1]

Line	Cost particulars	From Minot, N. Dak. to Duluth, Minn.				From Kansas City, Mo. to Baltimore, Md.			
		Commodity[2]				Commodity[2]			
		Wheat	Corn	Barley	Soybeans	Wheat	Corn	Barley	Soybeans
1	Territorial movement[3]	3-3	3-3	3-3	3-3	3-1	3-1	3-1	3-1
2	Out-of-pocket costs								
3	Terminal costs								
4	Unit cost per carload, cents	5,776	5,776	5,776	5,776	5,208	5,208	5,208	5,208
5	Short-tons per carload[4]	55	53	50	52	55	49	50	50
6	Unit cost per ton, cents	17.17	17.17	17.17	15.84	25.72	25.72	25.72	24.39
7	Line 5 x 6, cents	944.35	910.01	858.50	823.68	1,414.60	1,260.28	1,286.00	1,219.50
8	Terminal costs per carload (Line 4 + 7), cents	6,720.35	6,686.01	6,634.50	6,599.68	6,622.60	6,468.28	6,494.00	6,427.50
9	Line-haul costs								
10	Way-train car-miles[4 5]	58	58	58	58	47	47	47	47
11	Through-train car-miles[5]	427	427	427	427	1,093	1,093	1,093	1,093
12	Way-train ton-miles (Line 5 x 10)	3,190	3,074	2,900	3,016	2,585	2,303	2,350	2,350
13	Unit cost per way-train ton-mile, cents	.3353	.3353	.3353	.3353	.3371	.3371	.3371	.3371
14	Line 12 x 13, cents	1,069.61	1,030.71	972.37	1,011.26	871.40	776.34	792.18	792.18
15	Through-train ton-miles (Line 5 x 11)	23,485	22,631	21,350	22,204	60,115	53,557	54,650	54,650
16	Unit cost per through-train ton-mile, cents	.2164	.2164	.2164	.2164	.2148	.2148	.2148	.2148
17	Line 15 x 16, cents	5,082.15	4,897.35	4,620.14	4,804.95	12,912.70	11,504.04	11,738.82	11,738.82
18	Unit cost per way-train car-mile, cents	16.94	16.94	16.94	16.94	18.77	18.77	18.77	18.77
19	Line 10 x 18, cents	982.50	982.50	982.50	982.50	882.19	882.19	882.19	882.19
20	Unit cost per through-train car-mile, cents	13.05	13.05	13.05	13.05	14.75	14.75	14.75	14.75
21	Line 11 x 20, cents	5,572.35	5,572.35	5,572.35	5,572.35	16,121.75	16,121.75	16,121.75	16,121.75
22	Total line-haul costs per carload (Line 14 + 17 + 19 + 21), cents	12,706.61	12,482.91	12,147.36	12,371.06	30,788.04	29,284.32	29,534.94	29,534.94
23	Total out-of-pocket costs per carload Line 8 + 22), cents[6]	19,426.98	19,168.94	18,781.88	18,970.76	37,410.64	35,752.60	36,028.94	35,962.44
24	Out-of-pocket cost per cwt., cents	17.66	18.08	18.78	18.24	34.01	36.48	36.03	35.96
25	Out-of-pocket cost per bushel, cents	10.60	10.12	9.01	10.94	20.41	20.43	17.29	21.58
26	Constant costs								
27	Terminal unit cost, cents per ton	62.25	62.25	62.25	62.25	56.23	56.23	56.23	56.23
28	Line 5 x 27, cents	3,423.75	3,299.25	3,112.50	3,237.00	3,092.65	2,755.27	2,811.50	2,811.50
29	Total ton-miles (Line 12 + 15)	26,675	25,705	24,250	25,220	62,700	55,860	57,000	57,000
30	Line-haul unit cost, cents per ton-mile	.3375	.3375	.3375	.3375	.3178	.3178	.3178	.3178
31	Line 29 x 30, cents	9,002.81	8,675.44	8,184.38	8,511.75	19,926.06	17,752.31	18,114.60	18,114.60
32	Total constant costs per carload (Line 28 + 31), cents	12,426.56	11,974.69	11,296.88	11,748.75	23,018.71	20,507.58	20,926.10	20,926.10
33	Fully-distributed costs per carload (Line 23 + 32), cents	31,853.54	31,143.63	30,078.76	30,719.51	60,429.35	56,260.18	56,955.04	56,888.54
34	Fully-distributed cost per cwt., cents	28.96	29.38	30.08	29.54	54.94	57.41	56.96	56.89
35	Fully-distributed cost per bushel, cents	17.38	16.45	14.44	17.72	32.96	32.15	27.34	34.13

Line	Cost particulars	From Chicago, Ill. to Baltimore, Md.				From Kansas City, Mo. to Wilmington, N.C.			
		Commodity[2]				Commodity[2]			
		Wheat	Corn	Barley	Soybeans	Wheat	Corn	Barley	Soybeans
1	Territorial movement[3]	1-1	1-1	1-1	1-1	3-2	3-2	3-2	3-2
2	Out-of-pocket costs								
3	Terminal costs								
4	Unit cost per carload, cents	5,503	5,503	5,503	5,503	4,417	4,417	4,417	4,417
5	Short-tons per carload[4]	54	53	49	53	58	49	50	54
6	Unit cost per ton, cents	34.27	34.27	34.27	32.94	15.89	15.89	15.89	14.57
7	Line 5 x 6, cents	1,850.58	1,816.31	1,679.23	1,745.82	921.62	778.61	794.50	786.78
8	Terminal costs per carload (Line 4 + 7), cents	7,353.58	7,319.31	7,182.23	7,248.82	5,338.62	5,195.61	5,211.50	5,203.78
9	Line-haul costs								
10	Way-train car-miles[4 5]	32	32	32	32	62	62	62	62
11	Through-train car-miles[5]	735	735	735	735	1,262	1,262	1,262	1,262
12	Way-train ton-miles (Line 5 x 10)	1,728	1,696	1,568	1,696	3,596	3,038	3,100	3,348
13	Unit cost per way-train ton-mile, cents	.3427	.3427	.3427	.3427	.3233	.3233	.3233	.3233
14	Line 12 x 13, cents	592.19	581.22	537.35	581.22	1,162.59	982.19	1,002.23	1,082.41
15	Through-train ton-miles (Line 5 x 11)	39,690	38,955	36,015	38,955	73,196	61,838	63,100	68,148
16	Unit cost per through-train ton-mile, cents	.2291	.2291	.2291	.2291	.2194	.2194	.2194	.2194
17	Line 15 x 16, cents	9,297.90	8,924.59	8,251.04	8,924.59	16,059.20	13,567.26	13,844.14	14,951.67
18	Unit cost per way-train car-mile, cents	20.63	20.63	20.63	20.63	16.39	16.39	16.39	16.39
19	Line 10 x 18, cents	660.16	660.16	660.16	660.16	1,016.18	1,016.18	1,016.18	1,016.18
20	Unit cost per through-train car-mile, cents	16.64	16.64	16.64	16.64	13.05	13.05	13.05	13.05
21	Line 11 x 20, cents	12,230.40	12,230.40	12,230.40	12,230.40	16,469.10	16,469.10	16,469.10	16,469.10
22	Total line-haul costs per carload (Line 14 + 17 + 19 + 21), cents	22,780.65	22,396.37	21,678.95	22,396.37	34,707.07	32,034.73	32,331.65	33,519.36
23	Total out-of-pocket costs per carload (Line 8 + 22), cents[6]	30,134.23	29,715.68	28,861.18	29,645.19	40,045.69	37,230.34	37,543.15	38,723.14
24	Out-of-pocket cost per cwt., cents	27.90	28.03	29.45	27.97	34.52	37.99	37.54	35.85
25	Out-of-pocket cost per bushel, cents	16.74	15.70	14.14	16.78	20.71	21.27	18.02	21.51
26	Constant costs								
27	Terminal unit cost, cents per ton	50.19	50.19	50.19	50.19	52.15	52.15	52.15	52.15
28	Line 5 x 27, cents	2,710.26	2,660.07	2,459.31	2,660.07	3,024.70	2,555.35	2,607.50	2,816.10
29	Total ton-miles (Line 12 + 15)	41,418	40,651	37,583	40,651	76,792	64,876	66,200	71,496
30	Line-haul unit cost, cents per ton-mile	.2980	.2980	.2980	.2980	.3543	.3543	.3543	.3543
31	Line 29 x 30, cents	12,342.56	12,114.00	11,199.73	12,114.00	27,207.41	22,985.57	23,454.66	25,331.03
32	Total constant costs per carload (Line 28 + 31), cents	15,052.82	14,774.07	13,659.04	14,774.07	30,232.11	25,540.92	26,062.16	28,147.13
33	Fully-distributed costs per carload (Line 23 + 32), cents	45,187.05	44,489.75	42,520.22	44,419.26	70,277.80	62,771.26	63,605.31	66,870.27
34	Fully-distributed cost per cwt., cents	41.84	41.97	43.39	41.90	60.58	64.05	63.61	61.92
35	Fully-distributed coat per bushel, cents	25.10	23.50	20.83	25.14	36.35	35.87	30.53	37.15

[1] Estimated from data in table 37.
[2] Weights per bushel: Wheat, 60 pounds; corn, 56 pounds; barley, 48 pounds; and soybeans, 60 pounds.
[3] Territorial code: 1-Official; 2-South; 3-West.
[4] (See 57).
[5] The combination of way-train and through-train car-miles equals the short-line rail distance between origin and destination.
[6] Totals may not equal exactly the sum of the costs due to rounding.

TABLE 37. --Estimated railroad costs (per service unit), 1957[1]

Territorial movement code[2]	Out-of-pocket costs[3]							Constant costs	
	Terminal costs per			Line haul costs per				Terminal costs per ton	Line haul costs per ton-mile
	Carload	Ton		Way train car mile	Through car mile	Way train ton-mile	Through train ton-mile		
		Grains	Soybeans						
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
1-1	5503	34.27	32.94	20.63	16.64	.3427	.2291	50.19	.2980
2-2	3544	14.61	13.29	15.83	13.06	.3132	.2256	42.05	.3710
3-3	5776	17.17	15.84	16.94	13.05	.3353	.2164	62.25	.3375
1-2	4445	24.44	23.11	18.22	14.79	.3276	.2228	46.13	.3346
2-1	4445	24.44	23.11	18.22	14.79	.3276	.2228	46.13	.3346
1-3	5208	25.72	24.39	18.77	14.75	.3371	.2148	56.23	.3178
3-1	5208	25.72	24.39	18.77	14.75	.3371	.2148	56.23	.3178
2-3	4417	15.89	14.57	16.39	13.05	.3233	.2194	52.15	.3543
3-2	4417	15.89	14.57	16.39	13.05	.3233	.2194	52.15	.3543

[1] Based on information furnished by the Cost Finding Section, Bureau of Accounts-Cost Finding and Valuation, Interstate Commerce Commission. The costs do not include any allowance for circuitous routings.

[2] Territorial code: 1-Official; 2-South; 3-West.

[3] See (57), pp. 1-2, (55).

TABLE 38.--Estimated annual operating costs of inland waterway towboats and barges, 1956 existing fleets[1]

Costs	1,500-1,800 hp. towboat[2]		Covered barge, 195' x 35'[2]
	Under way	In port	
	Dollars	*Dollars*	*Dollars*
Annual fixed charges:			
Interest[3]	7,800	7,800	1,275
Depreciation	[4] 23,100	[4] 23,100	[5] 3,535
Total fixed charges	30,900	30,900	4,810
Administration and supervision	[6] 43,400	[6] 43,400	[7] 675
Operating expenses:			
Wages and allowances	145,000	145,000	---
Fuel	65,100	22,100	---
Maintenance and repairs	30,000	30,000	1,620
Supplies	13,500	9,450	---
Subsistence	13,100	6,550	---
Insurance	17,600	17,600	[8] 1,910
Other expenses	5,000	5,000	350
Taxes, other than income[9]	3,900	3,900	635
Total charges and expenses	367,500	313,900	10,000
Profit[10]	19,500	19,500	3,185
Contingencies[11]	19,400	16,700	660
Total charges, expenses and profit	406,400	350,100	13,845
Average cost per hour	[12] 49.10	[12] 42.30	[13] 1.58

[1] Basic cost data as of December, 1956 furnished by the Board of Engineers for Rivers and Harbors, Corps of Engineers, U. S. Army, Washington, D. C.
[2] Towboat investment, $390,000; barge investment, $63,700.
[3] Interest computed at 4 percent on one-half of investment.
[4] Depreciation, 5.92 percent annually.
[5] Depreciation, 5.55 percent annually.
[6] 15 percent of vessel operating cost.
[7] Overhead.
[8] 3 percent on investment.
[9] 1 percent on investment.
[10] 5 percent on investment.
[11] 5 percent of total costs and profit.
[12] Based on 345-day annual operation.
[13] Based on 365-day annual operation.

TABLE 39.--Navigation seasons: Inland waterways of the United States

Year	Upper Mississippi River (Minneapolis, Minn. to the mouth of the Mississippi River)			Missouri River (Kansas City, Mo. to the mouth)			New York State Barge Canal (From Buffalo, N. Y. on Lake Erie and Oswego, N. Y. on Lake Ontario to Albany, N. Y.)		
	Opening of navigation	Closing of navigation	Length of navigation season	Opening of navigation	Closing of navigation	Length of navigation season	Opening of navigation	Closing of navigation	Length of navigation season
	Date	*Date*	*Days*	*Date*	*Date*	*Days*	*Date*	*Date*	*Days*
1952.....	March 22	Dec. 9	263	March 15	Nov. 30	261	Apr. 11	Dec. 1	236
1953.....	March 8	Nov. 28	256	March 15	Nov. 30	261	Apr. 6	Dec. 3	242
1954.....	March 8	Nov. 28	256	March 15	Nov. 30	261	Apr. 12	Dec. 6	239
1955.....	March 21	Dec. 6	261	March 15	Nov. 30	261	Apr. 11	Dec. 10	244

Waterborne Commerce of the United States, Dept. of the Army, Corps of Engineers, 1952, 1953, 1954 and 1955; Annual Reports of the Lake Carriers Association.

TABLE 40. --Inland waterway distances in statute miles and running times[1]

Origin	Destination									
	New Orleans, La.		Chicago, Ill.[2]		Guntersville, Ala.		Chattanooga, Tenn.		Memphis, Tenn.	
	Distance	Time	Distance	Time	Distance	Time	Distance	Time	Distance	Time
	Miles	*Hours*	*Miles*	*Hours*	*Miles*	*Hours*	*Miles*	*Hours*	*Miles*	*Hours*
St. Paul-Minneapolis, Minn.....	1,724	236.55	968	187.91	1,258	240.76	1,364	267.97	1,086	164.09
Burlington, Iowa.....	1,275	164.12	519	115.47	809	168.33	915	195.54	---	---
Chicago, Ill.....	1,422	198.26	---	---	956	202.46	1,062	229.67	785	125.79
St. Louis, Mo.....	1,051	128.00	371	95.23	585	132.21	619	159.42	---	---
Memphis, Tenn.....	638	72.47	785	191.03	---	---	---	---	---	---
Peoria, Ill.....	1,252	165.40	171	43.79	785	169.61	819	196.82	---	---
Omaha, Nebr.....	1,701	232.84	981	191.29	1,235	224.90	1,341	252.11	---	---
Kansas City, Mo.....	1,446	191.71	726	150.16	980	195.92	1,086	223.13	806	118.86
Cincinnati, Ohio.....	1,382	184.09	1,062	226.51	822	169.12	928	196.33	---	---
Evansville, Ind.....	1,060	130.42	740	172.84	500	115.46	606	142.67	---	---

[1] Distances are expressed in statute miles. These may vary slightly from short-line mileages since they are based on combinations of mileages on the various rivers and between various ports.
[2] Distance computed on basis of movement to Calumet harbor.

Distances from "List of Lights and Other Marine Aids, Mississippi River System, Treasury Dept., U. S. Coast Guard, 1957," and steaming times computed from average speed data for tows furnished by the Board of Engineers for Rivers and Harbors, Corps of Engineers, U. S. Army.

TABLE 41.--Barge line charges and estimated costs, in cents per bushel, for transporting grains in a representative tow between selected inland waterway ports, 1957[1]

Origin and commodity	Destination									
	Chicago, Ill.		New Orleans, La.		Chattanooga, Tenn.		Guntersville, Ala.		Memphis, Tenn.	
	Charge	Cost	Charge	Cost	Charge	Cost	Charge	Cost	Charge	Cost
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Burlington, Iowa:										
Wheat and soybeans....	9.15	3.85	11.58	5.07	12.67	5.81	11.68	5.40	---	---
Corn.....	8.54	4.12	10.81	5.43	11.82	6.22	10.90	5.78	---	---
Barley.....	7.32	4.81	9.26	6.33	10.14	7.26	9.34	6.74	---	---
Chicago, Ill.:										
Wheat and soybeans....	---	---	13.56	5.90	14.99	6.64	13.78	5.98	9.18	4.11
Corn.....	---	---	12.66	6.32	13.99	7.11	12.86	6.40	8.57	4.40
Barley.....	---	---	10.85	7.37	11.99	8.29	11.03	7.47	7.34	5.13
Cincinnati, Ohio:										
Wheat and soybeans....	18.63	6.56	15.75	5.55	11.37	5.83	10.50	5.16	---	---
Corn.....	17.39	7.03	14.70	5.94	10.61	6.24	9.80	5.53	---	---
Barley.....	14.90	8.19	12.60	6.93	9.10	7.28	8.40	6.44	---	---
Evansville, Ind.:										
Wheat and soybeans....	16.56	5.25	12.36	4.24	8.58	4.52	7.35	3.85	---	---
Corn.....	15.46	5.62	11.54	4.54	8.01	4.84	6.86	4.12	---	---
Barley.....	13.25	6.56	9.89	5.30	6.86	5.65	5.88	4.81	---	---
Kansas City, Mo.:										
Wheat and soybeans....	10.41	4.70	13.71	5.74	15.42	6.48	14.12	5.82	10.44	3.94
Corn.....	9.72	5.03	12.80	6.15	14.39	6.94	13.18	6.23	9.74	4.22
Barley.....	8.33	5.87	10.97	7.17	12.34	8.09	11.30	7.27	8.36	4.92
Memphis, Tenn.:										
Wheat and soybeans....	10.68	5.70	6.63	2.83	---	---	---	---	---	---
Corn.....	9.97	6.10	6.19	3.03	---	---	---	---	---	---
Barley.....	8.54	7.12	5.30	3.53	---	---	---	---	---	---
Minneapolis, Minn.:										
Wheat and soybeans....	11.82	5.62	15.60	6.83	16.72	7.58	15.42	6.91	12.08	5.04
Corn.....	11.03	6.02	14.56	7.31	15.60	8.12	14.39	7.40	11.28	5.40
Barley.....	9.46	7.02	12.48	8.53	13.37	9.47	12.34	8.63	9.66	6.29
Omaha, Nebr.:										
Wheat and soybeans....	12.30	5.70	15.60	6.74	17.37	7.19	16.07	6.53	---	---
Corn.....	11.48	6.10	14.56	7.22	16.21	7.70	15.00	6.99	---	---
Barley.....	9.84	7.12	12.48	8.42	13.89	8.98	12.85	8.16	---	---
Peoria, Ill.:										
Wheat and soybeans....	4.41	2.10	10.56	5.10	13.04	5.84	12.08	5.18	---	---
Corn.....	4.12	2.25	9.86	5.46	12.17	6.25	11.28	5.55	---	---
Barley.....	3.53	2.62	8.45	6.37	10.43	7.29	9.66	6.47	---	---
St. Louis, Mo.:										
Wheat and soybeans....	5.82	3.36	8.67	4.18	9.24	4.93	7.94	4.26	---	---
Corn.....	5.43	3.60	8.09	4.48	8.62	5.28	7.41	4.56	---	---
Barley.....	4.66	4.20	6.94	5.22	7.39	6.16	6.35	5.32	---	---

[1] Barge line rates were taken from published tariffs and are based on bargeload lots. For cost data, see table 38. One-way trip costs are allocated to the one-way cargo movements. The representative tow includes a towboat of 1,500-1,800 hp. and 6 "jumbo" barges, each with a capacity of 40,000 bushels of wheat or soybeans.

TABLE 42. --Relationship of barge line charges to computed costs for transporting wheat into selected inland waterway ports, 1957[1]

Destination port				
Chattanooga, Tenn.	Chicago, Ill.	Guntersville, Ala.	Memphis, Tenn.	New Orleans, La.
Percent 215.50	*Percent* 228.36	*Percent* 219.17	*Percent* 242.67	*Percent* 238.10

[1] Barge line rates were taken from published tariffs and are based on bargeload lots. For cost data, see tables 38 and 41. The relationship shown is an average relationship of the tows into the selected ports from the following origin ports: Burlington, Ia.; Chicago, Ill.; Cincinnati, Ohio; Evansville, Ind.; Kansas City, Mo.; Memphis, Tenn.; Minneapolis, Minn.; Omaha, Nebr.; Peoria, Ill.; and St. Louis, Mo.

TABLE 43. --Estimated grain transportation charges in cents per bushel over existing all-water routings from selected ports on the Great Lakes to Montreal, Buffalo, Oswego, and New York City[1]

Origin	Destination			
	Montreal	Buffalo	Oswego[2]	New York City
	Cents	*Cents*	*Cents*	*Cents*
Duluth, Minn.	16.00	10.00	11.00	---
Chicago, Ill.[3]	16.00	10.00	11.00	---
Toledo, Ohio	10.00	[4] 6.00	7.00	---
Buffalo, N. Y.	---	---	---	[5] 9.00
Oswego, N. Y.	---	---	---	[5] 8.00

[1] Charges must of necessity be approximations as they vary from month to month and from season to season. The above charges are believed to be representative of those effective during the 1956 navigation season on the Great Lakes-New York State Barge Canal-Hudson River routings. Charter rates, lower and higher than the above, have occurred since charter rates, in large part, depend upon the availability of vessels. This availability depends in part on the availability of higher value cargo, such as iron ore. A limited volume of grain moves as backhaul in the bulk cargo "Upper Lakes" vessels moving newsprint to U. S. ports from Canada at very low rates. Integrated barge tows move limited volumes of grain at very low rates as back-haul cargo for movements of newsprint cargo from Maine to Great Lakes ports. Charges in cents per bushel for moving different grains and for moving soybeans will vary. In particular, barley moves at slightly lower charges per bushel than other grains. The analysis assumes the above rates apply to all grains, and to soybeans.

[2] Members of the grain trade indicated rates to Oswego are about 1 cent a bushel higher than rates to Buffalo.

[3] Rates from Chicago may be slightly less than rates from Duluth-Superior.

[4] The rate is estimated by the author and reflects the comparatively short haul. The charge for a comparable haul between Fort William and Duluth is 6 cents a bushel as indicated by the Statistics Branch, Board of Grain Commissioners for Canada, Winnepeg, Man., in their August 22, 1957 report, "Weighted Average Lake Freight Rates for Shipments of Grain from Fort William-Port Arthur, Month of July 1957."

[5] These are average rates covering the movement of all grains and soybeans during 1956 and are quoted from the Annual Report, 1956, State of New York, Department of Public Works.

TABLE 44. --Selected United States traffic movements on the Great Lakes, calendar years 1952 through 1956[1]

Commodity and year	Direction of movement: Out--upstream on--			Direction of movement: In--upstream on--		
	St. Lawrence River	Lake Ontario	Lake Erie	Lake Huron	Lake Michigan	Lake Superior
	1,000 short tons	1,000 short tons	1,000 short tons	1,000 short tons	1,000 short tons	1,000 short tons
Coal:						
1952	---	587	20,396	20,396	6,966	10,100
1953	---	10	22,338	22,338	9,152	8,758
1954	---	6	20,109	20,109	9,724	6,460
1955	---	76	22,274	22,274	9,540	9,410
1956	---	---	22,218	22,218	8,507	10,752
Average	---	136	21,467	21,467	8,778	9,096
Iron ore:						
1952	202	87	61	61	48	13
1953	44	44	64	64	9	---
1954	241	241	82	82	81	---
1955	1,071	964	58	58	---	58
1956	2,204	2,521	68	68	---	---
Average	753	771	66	66	28	14

	Direction of movement: Out--downstream on--			Direction of movement: In--downstream on--		
	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario	St. Lawrence River
	1,000 short tons	1,000 short tons	1,000 short tons	1,000 short tons	1,000 short tons	1,000 short tons
Wheat:						
1952	3,240	155	3,192	3,186	283	178
1953	2,018	100	2,105	2,105	163	6
1954	2,208	231	2,436	2,436	192	3
1955	2,097	140	2,200	2,200	251	21
1956	2,607	216	2,834	2,834	208	---
Average	2,434	168	2,553	2,552	219	42
Corn:						
1952	106	358	458	458	178	108
1953	410	278	685	685	270	166
1954	561	368	814	814	241	183
1955	126	70	188	188	94	57
1956	3	196	193	193	198	148
Average	241	254	468	468	196	132
Barley and rye:						
1952	605	5	255	255	24	7
1953	937	3	188	188	49	3
1954	834	8	426	426	43	8
1955	1,023	17	705	705	146	8
1956	1,250	3	745	745	94	3
Average	930	7	464	464	71	6
Oats:						
1952	903	8	569	569	32	---
1953	895	---	815	815	3	---
1954	412	5	385	385	4	---
1955	126	26	152	152	23	---
1956	230	1	231	231	37	---
Average	513	8	430	430	20	---
Flaxseed:						
1952	104	---	104	104	9	---
1953	119	---	119	119	13	---
1954	449	---	449	449	225	152
1955	275	---	275	275	77	2
1956	235	---	235	235	76	8
Average	237	---	237	237	80	32
All grain:						
Total of averages	4,355	437	4,152	4,151	586	212

[1] Tonnage was approximated from graphic flow charts of traffic moving on the Great Lakes as prepared by the Great Lakes Regional Statistical Office, Great Lakes Division, Corps of Engineers, U. S. Army, 1952 through 1956.

TABLE 45.--Shipments of grain and soybeans from selected ports located on the Great Lakes, calendar years 1953 through 1956

Port and year	Mode of transport		Commodity							Total, all grain and soybeans
	Lake	Other[1]	Wheat	Corn	Barley	Soybeans	Rye	Oats	Flaxseed	
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
Duluth, Minn., and Superior, Wisconsin[2]										
1953	80,640	34,767	72,162	15,244	16,645	---	1,882	5,521	3,953	115,407
1954	115,876	28,125	84,128	20,129	14,742	---	1,996	8,223	14,783	144,001
1955	111,446	28,992	76,701	6,667	34,114	837	4,083	7,883	10,153	140,438
1956	126,395	27,154	93,427	148	29,491	817	8,383	12,839	8,444	153,549
Chicago, Illinois[3]										
1953	14,393	83,921	17,578	45,173	1,876	6,480	3,907	23,282	18	98,314
1954	23,706	76,363	22,107	40,809	1,679	13,855	3,799	17,798	22	100,069
1955	11,856	85,250	15,432	41,517	1,510	10,142	4,067	24,436	2	97,106
1956	19,789	91,345	24,660	44,964	2,957	15,468	3,051	19,998	36	111,134
Toledo, Ohio[4]										
1953	3,952	36,228	17,042	16,726	8	3,402	14	2,988	17,042	40,180
1954	9,365	41,379	20,544	20,148	36	4,384	27	5,605	20,544	50,744
1955	7,715	53,189	12,057	34,248	108	6,599	7	7,885	12,057	60,904
1956	7,511	69,977	18,659	41,947	175	4,346	88	12,273	18,659	77,488

[1] Includes shipments by rail from Duluth, Minn.-Superior, Wisc., and by rail and barge from Chicago, Ill. Includes shipments by rail and truck from Toledo, Ohio.

[2] Annual Reports of the Duluth Board of Trade.

[3] Northwestern Miller, Almanack No., May 28, 1957; flaxseed data from the Board of Trade, Chicago, 1956.

[4] Toledo Board of Trade; Annual Reports of the Lake Carriers' Association; and the Northwestern Miller, Almanack No., May 28, 1957.

TABLE 46. --Grain received from various ports at the port of Buffalo, 1957[1]

Origin	Grains[2]					
	Wheat	Corn	Barley-rye	Oats	Flax	Total
	1,000 bushels	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*
Chicago, Ill.....	2,326	5,422	64	---	---	7,812
Duluth, Minn.....	54,225	2,061	16,503	5,420	2,955	81,164
Milwaukee, Wis.....	478	40	15	---	---	533
Toledo, Ohio.....	1,118	1,018	---	---	---	2,136
Saginaw, Mich.....	497	482	---	---	---	979
Port Arthur, Can.....	1,879	---	956	10,500	---	13,335
Ft. William, Can.....	2,462	---	1,078	4,841	---	8,381
Total.....	62,985	9,023	18,616	20,761	2,955	114,340

[1] From the opening of navigation to the close, including winter storage fleet, according to records of the Corn Exchange of Buffalo, N. Y.
[2] No soybean receipts were reported.

TABLE 47.--Distances in statute miles: U. S. Great Lakes' ports to Montreal, Canada, on completion of the St. Lawrence Seaway

	Duluth, Minn. to Montreal Canada					Chicago, Ill. to Montreal, Canada					Toledo, Ohio to Montreal, Canada				
	Locks	Open water	Channels with speed restrictions	Canal	Total	Locks	Open water	Channels with speed restrictions	Canal	Total	Locks	Open water	Channels with speed restrictions	Canal	Total
	Number	*Miles*	*Miles*	*Miles*	*Miles*	*Number*	*Miles*	*Miles*	*Miles*	*Miles*	*Number*	*Miles*	*Miles*	*Miles*	*Miles*
Duluth, Minn. to Point Iroquois, at the foot of Lake Superior	0	383	0	0	383	---	---	---	---	---	---	---	---	---	---
Point Iroquois to Lake Huron via the St. Marys River	1	0	61	2	63	---	---	---	---	---	---	---	---	---	---
Through Lake Huron to Port Huron, at the foot of Lake Huron	0	223	0	0	223	---	---	---	---	---	---	---	---	---	---
Chicago, Ill. to Port Huron	---	---	---	---	---	0	568	0	0	568	---	---	---	---	---
Port Huron to Detroit River Light on Lake Erie, via the St. Clair River, Lake St. Clair, and the Detroit River.	0	0	90	0	90	0	0	90	0	90	---	---	---	---	---
Detroit River Light via Lake Erie to Port Colborne, Can.	0	218	0	0	218	0	218	0	0	218	---	---	---	---	---
Toledo, Ohio via Lake Erie to Port Colborne, Canada	---	---	---	---	---	---	---	---	---	---	0	235	0	0	235
Port Colborne, Can. via the Welland Canal to Port Weller, Can. on Lake Ontario	8	0	0	27	27	8	0	0	27	27	8	0	0	27	27
Port Weller, Can. via Lake Ontario to Tibbets Point on Lake Ontario	0	157	0	0	157	0	157	0	0	157	0	157	0	0	157
Tibbets Point via the St. Lawrence River to Chimney Point, Thousand Islands	0	68	0	0	68	0	68	0	0	68	0	68	0	0	68
Chimney Point via the International Rapids and Canadian sections of the St. Lawrence River to Montreal, Can.	7	0	77	37	114	7	0	77	37	114	7	0	77	37	114
Total	16	1,049	228	66	1,343	15	1,011	167	64	1,242	15	460	77	64	601

See (66) and (22).

TABLE 48.--Running time: "Upper Laker" bulk cargo ship[1]

From	To	Distance	Time[2]	Distance	Time[3]	Distance	Time[4]	Total distance	Time	
		Open water		Channels with speed restrictions		Canals and locks			Subtotal	Subtotal plus 10 percent[5]
		Statute miles	*Hours*	*Statute miles*	*Hours*	*Statute miles*	*Hours*	*Statute miles*	*Hours*	*Hours*
Duluth	Buffalo	833	57.85	151	12.38	2	1.00	986	71.23	78.35
Chicago	Buffalo	795	55.21	90	7.38	---	---	885	62.59	68.85
Toledo	Buffalo	254	17.64	---	---	---	---	254	17.64	19.40
Duluth	Oswego	965	67.01	151	12.38	29	10.00	1,145	89.39	98.33
Chicago	Oswego	927	64.38	90	7.38	27	9.00	1,044	80.76	88.84
Toledo	Oswego	376	26.11	---	---	27	9.00	403	35.11	38.62
Duluth	Montreal	1,049	72.85	228	18.69	66	21.00	1,343	112.54	123.79
Chicago	Montreal	1,011	70.21	167	13.69	64	20.00	1,242	103.90	114.29
Toledo	Montreal	460	31.94	77	6.31	64	20.00	601	58.25	64.08
Montreal	Seven Islands	484	33.61	---	---	---	---	484	33.61	36.97

[1] The ship is an "Upper Laker" of the "Thunder Bay" class, not suitable for operation on the oceans. It has a rated speed of 14.4 m.p.h. and a capacity of 623,000 bushels of wheat at 25 1/2-foot draft.
[2] Time computed on basis of 14.4 m.p.h.
[3] Time computed on basis of rated speed less 15 percent, or 12.2 m.p.h.
[4] Times taken from "The St. Lawrence Survey, Part II, Shipping Services on the St. Lawrence River," by Dr. N. R. Danielian, U. S. Department of Commerce, 1941, page 22.
[5] Total time plus (10) percent--to compensate for possible delays due to inclement weather, delays in entering locks, time spent at toll collecting points, lower vessel speed due to increased draft under weigh relative to draft at rest, and within-harbor movements at origin and destination.

TABLE 49.--Estimated grain transporting costs in "Upper Laker" bulk cargo vessel from the Head of Lakes (Ft. William-Port Arthur, Can.) to Kingston, Ontario, during the summer season of 230 days, 1955

Ship and voyage particulars[1]	Country where built and registered	
	Canada	
Size of vessel: Length		647'3"
Breadth		67'0"
Depth		35'0"
Rated vessel speed--m.p.h.		14.4
Distance, round trip--statute miles		2,068
Voyage time, round trip:		
Running--hours	171.6	
Loading--hours	21.6	
Unloading--hours	49.6	
Subtotal--hours	242.8	
Plus 5 percent[2]	12.1	
Total voyage time--hours		254.9
Average running speed--m.p.h.		11.48
Trips per season of 230 days		21.7
Vessel capacity per trip at 25 1/2 ft. draft--bushels (60 lb.)		623,000
Bushels loaded per hour in port		28,843
Bushels unloaded per hour in port		12,561
Vessel capacity per trip at 25 1/2 ft. draft, gross tons (2,240 lb.)		16,700
Ton-miles per trip		17,267,800
Operating expenses--dollars[3]:		
Per trip		32,036.87
Per hour of running time[4]		177.79
Handling expenses--dollars:		
Per trip		6,230.41
Per hour of loading and unloading time[4]		83.41
Total expenses:		
Per trip--dollars		38,267.28
Per hour of voyage time--dollars		150.13
Per bushel transported--cents		6.15
Per gross ton transported--cents		229
Per gross ton-mile--cents		.222

[1] The vessel is an "Upper Laker" of the "Thunder Bay" class, not suitable for operation on the oceans. Boat constructed in 1955 at a cost of $4,600,000.

[2] The addition of 5 percent to total voyage time is to compensate for unforeseen delays.

[3] Includes the following variable expenses: wages, fuel, provision, repairs and maintenance, supplies, dues and other charges, overhead, insurance; also includes fixed expenses incidental to fitting it out and laying it up, depreciation, and interest at 2 1/2 percent. No profit margin is included.

[4] The addition of 5 percent of total voyage time has been allocated between running time and loading-unloading time.

Data either taken from or computed from information included in Exhibit No. 200 entitled, "Comparative Ship Operating Costs and Revenues, Vessels Operating Head of Lakes to Kingston, for Canada Steamship Lines, Ltd.," December 1, 1955, and filed with the Royal Commission in the Canadian Coasting Trade.

TABLE 50.--Estimated grain transportation costs in "Upper Laker" bulk cargo vessels operating between selected ports on the Great-Lakes-St. Lawrence waterway, 1957

Voyage particulars	Duluth, Minn. to Montreal, Can.	Chicago, Ill. to Montreal, Can.	Toledo, Ohio to Montreal, Can.	Duluth, Minn. to Seven Islands, Can.	Chicago, Ill. to Seven Islands, Can.	Toledo, Ohio to Seven Islands, Can.
Distance, round trip, statute miles	2,686	2,484	1,202	3,654	3,452	2,170
Voyage time, round trip:						
Running, hours	247.58	228.58	128.16	321.50	302.50	202.08
Loading, hours.....	24.00	24.00	24.00	24.00	24.00	24.00
Unloading, hours	48.00	48.00	48.00	48.00	48.00	48.00
Total voyage time, hours	319.58	300.58	200.16	393.50	374.50	274.08
Trips per season of 230 days	17.27	18.37	27.50	14.02	14.74	20.14
Vessel capacity per trip at 25½-foot draft, bushels (60 pounds).....	623,000	623,000	623,000	623,000	623,000	623,000
Vessel capacity per trip at 25½-foot draft, gross tons (2,240 lb.).....	16,700	16,700	16,700	16,700	16,700	16,700
Ton-miles per trip.....	22,428,100	20,741,400	10,036,700	30,510,900	28,824,200	18,119,500
Operating expenses per trip:[1]	$51,032.66	$47,131.19	$26,503.25	$67,308.34	$63,406.88	$42,778.92
Plus toll at 1½ cents per bushel.....	$9,345.00	$9,345.00	$9,345.00	$9,345.00	$9,345.00	$9,345.00
Total operating expenses, per trip	$60,377.66	$56,476.19	$35,848.25	$76,653.34	$72,751.88	$52,123.92
Handling expenses per trip[2].....	$7,196.12	$7,196.12	$7,196.12	$7,196.12	$7,196.12	$7,196.12
Total expenses:						
Per trip	$67,573.78	$63,672.31	$43,044.37	$83,849.46	$79,948.00	$59,320.04
Per hour of voyage time	$211.45	$211.83	$215.05	$213.09	$213.48	$216.43
Per bushel transported, cents	10.8465	10.2203	6.9092	13.4590	12.8327	9.5217
Per gross ton transported, cents.....	404.63	381.27	257.75	502.09	478.73	355.21
Per gross ton-mile, cents	.30129	.30698	.42887	.27482	.27736	.32738

Voyage particulars	Duluth, Minn. to Buffalo, N. Y.	Chicago, Ill. to Buffalo, N. Y.	Toledo, Ohio to Buffalo, N. Y.	Duluth, Minn. to Oswego, N. Y.	Chicago, Ill. to Oswego, N. Y.	Toledo, Ohio to Oswego, N. Y.
Distance, round trip, statute miles	1,972	1,770	508	2,290	2,088	806
Voyage time, round trip:						
Running, hours	156.70	137.70	38.80	196.66	177.68	77.24
Loading, hours	24.00	24.00	24.00	24.00	24.00	24.00
Unloading, hours	48.00	48.00	48.00	48.00	48.00	48.00
Total voyage time, hours	228.70	209.70	110.80	268.66	249.68	149.24
Trips per season of 230 days	24.13	26.32	49.82	20.55	22.11	36.99
Vessel capacity per trip at 25½-foot draft, bushel (60 pounds)	623,000	623,000	623,000	623,000	623,000	623,000
Vessel capacity per trip at 25½-foot draft, gross tons (2,240 lb.)	16,700	16,700	16,700	16,700	16,700	16,700
Ton-miles per trip.....	16,466,200	14,779,500	4,241,800	19,121,500	17,434,800	6,730,100
Operating expenses per trip:[1]	$32,189.66	$28,286.74	$7,971.04	$40,398.13	$36,499.32	$15,867.25
Plus toll at 1½ cents per bushel	---	---	---	---	---	---
Total operating expenses, per trip	$32,189.66	$28,286.74	$7,971.04	$40,398.13	$36,499.32	$15,867.25
Handling expenses per trip[2].....	$7,196.12	$7,196.12	$7,196.12	$7,196.12	$7,196.12	$7,196.12
Total expenses:						
Per trip	$39,385.78	$35,482.86	$15,167.16	$47,594.25	$43,695.44	$23,063.37
Per hour of voyage time	$172.22	$169.21	$136.89	$177.15	$175.01	$154.54
Per bushel transported, cents	6.3220	5.6955	2.4345	7.6395	7.0137	3.7020
Per gross ton transported, cents	235.84	212.47	90.82	285.00	261.65	138.10
Per gross ton-mile, cents	.23919	.24008	.35756	.24890	.25062	.34269

[1] The above operating expenses are based on data in table 49. The running time for the round trip from the Head of Lakes to Kingston, Ont., was 171.6 hours, increased to 180.13 hours to compensate for unforeseen delays. Under the Canadian flag, the operating expense per hour of running time was $177.79. To estimate the total operating expenses the round trip running times between Kingston and Montreal and between Montreal and Seven Islands were computed. The actual running times were estimated as 45.0 and 67.2 hours, respectively. These times were increased 10 percent for possible inclement weather, delay time in entering locks, toll collecting time, etc. This addition results in total round trip running times of 49.50 hours, between Kingston and Montreal, and 73.92 hours between Montreal and Seven Islands. Running times from Duluth, Chicago, and Toledo to Montreal, Buffalo, Oswego, and Seven Island are shown in table 48. The round trip running time from the Head of Lakes to Kingston was compared with those from Duluth, Chicago, and Toledo to Buffalo and Oswego, respectively, and the differences multiplied by the per hour running time expense factor. As applicable, the results were either added to or subtracted from the operating expense figure for the round trip, Head of Lakes to Kingston ($32,036.87). Similarly, the round trip steaming time from Head of Lakes to Montreal was compared with those from the U.S. ports to Montreal and to Seven Islands, and the differences multiplied by the per hour running time expense factor. As applicable, the results were either added to or subtracted from the operating expense figure for the round trip, Head of Lakes to Montreal ($40,822.97).

In addition to the operating expenses in the transportation cost analyses in table 49, pilotage expenses were added, as applicable, between Kingston and Montreal and between Kingston and Father's Point, Que. The above expenses also include an estimated toll charge of 1½ cents a bushel, applicable where the trip involves passage through the St. Lawrence Seaway, and adjustments to compensate for the increased level of costs occurring between 1955 and 1957, the Canadian dollar premium over the American dollar, and a reasonable profit margin.

[2] Handling expenses of $7,196.12 per round trip represent those grain handling expenses accruing to the vessel owner or operator. The base handling expense figure from the Head of Lakes to Kingston ($6,230.41, see table 49) was increased to compensate as above.

TABLE 51.--Tug and pilot service charges

Port or lakes	Channel	Tug service charge--one-way	Pilot service charge--one-way
		Dollars	*Dollars*
Duluth, Minn.....	Between Interstate Bridge and elevators on Duluth Harbor	[1] 202.60--average	70.00 plus out-of-pocket expenses per day
South Chicago, Ill.....	Between outside (Lake Michigan) to elevators on Calumet River and harbor	[1] 235.58--average	70.00 plus out-of-pocket expenses per day
Toledo, Ohio.....	Between Lake Erie and elevators on Toledo Harbor and the Maumee River	[1] 285.30--average	70.00 plus out-of-pocket expenses per day
Montreal, Can.....	Docking or undocking	[1] 140.00--average	---
New York City, N. Y.....	Between Ambrose Lightship and the N. Y. Port Authority Elevator	79.00	33.00 minimum plus 5.50 per foot draft for all draft over 6 feet
Baltimore, Md.....	Between Quarantine and Port Covington, including docking or undocking	277.00	8.50 per foot draft for vessels drawing 13 feet or more; 7.50 per foot draft for vessels drawing 10 and less than 13 feet
New Orleans, La.....	Docking or undocking. Pilot service: Between New Orleans and Pilottown, La.	120.00	4.25 per foot draft; minimum: 63.75
Portland, Oreg.....	Docking or undocking. Pilot service: Longview, Wash., terminal to the mouth of the Columbia River	[2] 120.00	$2\frac{1}{2}$ cents per foot of draft plus 2 cents per net registered ton
Great Lakes.....	Between Fathers Point, P. Q. and Montreal	---	42.50 per day
Great Lakes.....	Between Montreal and Kingston, Ont. (foreign vessels)	---	250.00 flat charge
Great Lakes.....	Between Kingston, Ont. and Great Lakes ports	---	42.50 per day

[1] Indicated charge applies to a Liberty vessel and it is an average of charges applicable to the several elevators.
[2] Docking or undocking tug service charge estimated.

Data obtained from authoritative private sources.

TABLE 52. --Comparative estimated transportation costs in cents per bushel for the movement of wheat and soybeans between selected ports in an "Upper Laker" bulk cargo vessel[1]

Origin	Destination							
	Buffalo, N. Y., USA		Montreal, P. Q., Can.		Oswego, N. Y., USA		Seven Islands, P. Q., Can.	
	1-way[2]	Round-trip[3]	1-way[2]	Round-trip[3]	1-way[2]	Round-trip[3]	1-way[2]	Round-trip[3]
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.....	3.74	6.32	6.75	10.85	4.40	7.64	8.06	13.46
Chicago, Ill.....	3.43	5.70	6.44	10.22	4.08	7.01	7.74	12.83
Toledo, Ohio.....	1.79	2.43	4.78	6.91	2.43	3.70	6.09	9.52

[1] Costs are computed f.o.b. vessel at port of destination for grain requiring 46.5 cubic feet of stowage per gross ton. For vessel particulars, see table 22.
[2] Expenses for the 1-way trip are allocated to the 1-way grain cargo movement. They are equivalent to one-half the operating expenses per round trip (table 50), plus the handling expenses and applicable toll.
[3] Expenses for the round-trip are allocated to the 1-way grain cargo movement, table 50.

TABLE 53. --Comparative estimated transportation costs in cents per bushel for the movement of corn between selected ports in an "Upper Laker" bulk cargo vessel[1]

Origin	Destination							
	Buffalo, N. Y., USA		Montreal P. Q., Can.		Oswego, N. Y., USA		Seven Islands, P. Q., Can.	
	1-way[2]	Round-trip[3]	1-way[2]	Round-trip[3]	1-way[2]	Round-trip[3]	1-way[2]	Round-trip[3]
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.....	4.01	6.77	7.23	11.62	4.71	8.18	8.63	14.42
Chicago, Ill.....	3.67	6.10	6.90	10.95	4.37	7.51	8.29	13.74
Toledo, Ohio.....	1.92	2.60	5.12	7.40	2.60	3.96	6.52	10.20

[1] Costs are computed f.o.b. port of destination. Corn requires 49.8 cubic feet of stowage per gross ton, or 107.1 percent of that (46.5 cubic feet) required for wheat,and soybeans. The computed transportation costs for wheat and soybeans (table 52) were multiplied by this factor (107.1 percent) to determine transportation costs for the movement of corn. For vessel particulars, see table 22.
[2] Expenses for the 1-way trip are allocated to the 1-way grain cargo movement. They are equivalent to one-half the operating expenses per round trip (table 50), plus the handling expenses and applicable toll.
[3] Expenses for the round trip are allocated to the 1-way grain cargo movement, table 50.

TABLE 54. --Comparative estimated transportation costs in cents per bushel for the movement of barley between selected ports in an "Upper Laker" bulk cargo vessel[1]

Origin	Destination							
	Buffalo, N. Y., USA		Montreal, P. Q., Can.		Oswego, N. Y., USA		Seven Islands, P.Q., Can.	
	1-way[2]	Round-trip[3]	1-way[2]	Round-trip[3]	1-way[2]	Round-trip[3]	1-way[2]	Round-trip[3]
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.	4.67	7.89	8.43	13.55	5.50	9.54	10.07	16.81
Chicago, Ill.	4.28	7.12	8.04	12.76	5.10	8.76	9.67	16.02
Toledo, Ohio	2.24	3.04	5.97	8.63	3.04	4.62	7.61	11.89

[1] Costs are computed f.o.b. port of destination. Barley requires 58.1 cubic feet of stowage per gross ton, or 124.9 percent of that (46.5 cubic feet) required for wheat and soybeans. The computed transportation costs for wheat and soybeans (table 52) were multiplied by this factor (124.9 percent) to determine the transportation costs for the movement of barley. For vessel particulars see table 22.

[2] Expenses for the 1-way trip are allocated to the 1-way grain cargo movement. They are equivalent to one-half the operating expenses per round trip (table 50), plus the handling expenses and applicable toll.

[3] Expenses for the round trip are allocated to the 1-way grain cargo movement, table 50.

TABLE 55. --Average water freight charges on the Great Lakes for Canadian grain

(in cents per bushel)

Voyage	Wheat			Barley		Oats		Flax		Rye	
	1954	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956
From Port William--Port Arthur to:											
Montreal	14.17	13.50	16.00	12.75	15.20	11.39	13.00	14.50	17.00	13.50	16.00
Port Colborne	6.46	6.06	7.58	5.75	7.32	5.30	6.71	6.54	8.01	6.02	7.87
Buffalo	6.09	6.70	8.39	5.39	6.84	5.24	5.12	---	9.00	5.71	7.02
From Port Colborne to Montreal	7.81	7.50	8.22	7.00	8.00	5.82	6.40	7.94	8.99	7.50	8.50

Canal Statistics, 1955 and 1956, Dominion Bureau of Statistics, Ottawa, Canada.

TABLE 56. --Grain fittings costs for a Liberty vessel, 1957[1]

Port	Cost	Port	Cost
	Dollars		*Dollars*
New York, N. Y.: Average for 4 companies	11,975	Portland, Oreg.: One company	8,550
Baltimore, Md.: Average for 2 companies	7,350	Montreal, Can.: One company	9,500
New Orleans, La.: Average for 3 companies	10,933		

[1] Grain fittings costs include labor and materials necessary to fit the vessel with bulkheads, bins, and feeders to accommodate 9,500 long tons of wheat. The costs are based on labor charges at straight time, with installation in a Liberty vessel equipped with steel centerline bulkhead.

Stevedoring and shipceiling companies.

TABLE 57. --Wheat harvest times throughout the world

Month	Country
January	New Zealand, Chile
February, March	East India, Upper Egypt
April	Lower Egypt, Syria, Cyprus, Persia, Asia Minor, India, Mexico
May	Algeria, Central Asia, China, Japan, Morocco, and Texas, U.S.A.
June	Turkey, Greece, Italy, Spain, Portugal, South of France, and the following U.S.A. States: Calif., La., Miss., Ala., Ga., N.C., S.C., Va., Ky., Kans., Ark., Utah, Mo., Okla.
July	Roumania, Bulgaria, Austria, Hungary, Czechoslovakia, South Russia, Germany, Switzerland, France, South of England, Ontario, Canada, and the following U.S.A. States: Oreg., Nebr., Minn., Wis., Colo., Wash., Iowa, Ill., Ind., Mich., Ohio, N.Y., Mont., and all of New England
August	Belgium, Holland, Great Britain, Denmark, Poland, Columbia, Quebec and Western Canada, N.Dak. and S.Dak., U.S.A.
September, October	Scotland, Sweden, Norway, North Russia
November	Peru, Australia, and South Africa
December	Burma, Argentina

Annual Report of the Chicago Board of Trade, 1956.

TABLE 58. --Corn harvest times throughout the World

Month	Country
January	New South Wales
March, April	Argentina
April, May	South Africa
September, October	All European countries
October and later	United States of America

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TABLE 59. --Wharfage and dockage costs at selected ports, 1957

Port	Costs
Montreal, Can.....	The cost is 6 cents per short ton plus a 10 percent surcharge.[1]
New York City, N. Y.....	Weehawken, N. J., New York Central Railroad grain elevator. Grain can be loaded directly from elevator to vessels. There is no wharfage or dockage charge for grain moving out of the elevator that has had a previous line haul on the New York Central Railroad.[2]
	Brooklyn, N. Y., Port Authority Grain Terminal. This elevator is served by truck and vessel on inbound movements of grain. There are no direct rail connections or track facilities at the elevator. The berthing area is dredged to 31 feet mean low water, providing ample depth for direct grain transfer from the elevator to vessels. New York railroads deliver grain to the terminal by lighters. The dockage charge for vessels of over 1,000 gross registered tons is $100.00 per vessel per day. The charge applies for one full day before grain loading commences; also for one full day following completion of grain loading. Dockage for prior or subsequent periods for vessels of over 2,000 gross registered tons is $100.00 per vessel per day.[3]
New Orleans, La.....	Public Grain Elevator Wharf or Sacking Plant. The dockage-wharfage charge is one cent per gross registered ton per day on all inland waterways, or coastwise vessels, or vessels engaged in foreign or intracoastal trade. This wharfage charge will apply on vessels handling either bulk or sacked grain to or from the elevator, and applied during the time the vessel is tied up to the wharf regardless whether working or not. (It has been proposed to increase dockage-wharfage charges to 2 1/2 cents per gross ton for the first day and one cent per gross ton for each succeeding day.)[4]
Portland, Oreg.....	The wharfage charge is 33-1/3 cents per ton of 2,000 pounds. This charge is assessed on all grain for the use of the grain facilities, whether or not such grain is eventually delivered to a vessel. No services are covered by this charge. Therefore, in this study, it has been included as part of the elevation charge, table 25.[5]
Baltimore, Md.....	The waterfront elevators are owned by the railroads and there are no wharfage or dockage charges at these privately owned facilities for direct transfer of grain from the elevators to vessels.[6]

[1] "Information, Eastern Canada Grain Elevators," prepared by Johnson and Dever, Ltd., Montreal, Can., December 1954, p. 9.
[2] Trunk Lines Tariff No. 116G, ICC A-1108.
[3] Port Authority Grain Terminal Tariff No. 1-D, items 1485 and 1495.
[4] Grain Tariff No. 15, Public Grain Elevator, Rule 1; Supplement 11, issued July 31, 1953 and Supplement 17 issued May 6, 1954.
[5] See p. 18 of (2).
[6] See p. 18 of (30).

TABLE 60. --Estimated costs at U. S. Atlantic ports for vessel-to-elevator transfer[1]

Costs	Vessel	
	Liberty	Lake-ocean bulk carrier
	Dollars	*Dollars*
Pilot service[2]	238.00	238.00
Tug service[2]	277.00	277.00
Wharfage[3]	400.00	400.00
Stevedoring[4]	7,127.46	13,688.10
Total vessel costs, dollars	8,042.46	14,603.10
Total vessel costs, cents per bushel[5]		
Wheat and soybeans	2.2680	2.1444
Corn	2.4290	2.2967
Barley	2.8327	2.6784

[1] For vessel particulars, see table 22. Charges are those paid by the vessel when contracts cover delivery of grain at destination port. The vessel-to-elevator transfer assumes that the grain would move from the elevator by truck, or by a conveyance other than rail.
[2] Charge is applicable at Baltimore, table 51.
[3] Charge is applicable at New York City, table 59.
[4] Table 26.
[5] For method used in computing costs for different commodities, see tables 52, 53, and 54.

TABLE 61.--Comparative estimated one-way and round-trip costs for transporting grain between selected United Stated ports and Rotterdam, Netherlands, in a Liberty-type vessel and in a lake-ocean bulk carrier, 1957[1]

Voyage particulars	Duluth, Minnesota				Chicago, Illinois				Toledo, Ohio	
	Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel	
	One-way[2]	Round trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]
Distance, nautical miles[4]	4,293	8,586	4,293	8,586	4,214	8,428	4,214	8,428	3,657	7,314
Voyage time:										
At sea, plus 1 day[5]...days	17.50	34.99	14.65	29.30	17.16	34.32	14.35	28.70	15.02	30.04
In port...days[6]	10.00	10.00	8.00	8.00	10.00	10.00	8.00	8.00	10.00	10.00
Total voyage time, days	27.50	44.99	22.65	37.30	27.16	44.32	22.35	36.70	25.02	40.04
Trips per navigation season[7]	---	5.45	---	6.57	---	5.53	---	6.68	---	6.12
Vessel capacity per trip at 25 1/2-foot draft:										
Bushels	317,300	317,300	560,000	560,000	317,300	317,300	560,000	560,000	317,300	317,300
Gross tons	8,500	8,500	15,000	15,000	8,500	8,500	15,000	15,000	8,500	8,500
Vessel capacity per trip at full draft:										
Bushels	354,600	354,600	681,000	681,000	354,600	354,600	681,000	681,000	354,600	354,600
Gross tons	9,500	9,500	18,255	18,255	9,500	9,500	18,255	18,255	9,500	9,500
Operating expenses per day:[8]										
At sea...dollars	1,669.27	1,669.27	3,217.50	3,217.50	1,699.27	1,699.27	3,217.50	3,217.50	1,669.27	1,669.27
In port...dollars	1,408.14	1,408.14	2,777.50	2,777.50	1,408.14	1,408.14	2,777.50	2,777.50	1,408.14	1,408.14
Operating expenses per trip ...dollars	43,285.28	72,489.16	69,356.37	116,492.75	42,726.07	71,370.75	68,391.12	114,562.07	39,153.83	64,226.27
Other expenses per trip...dollars:										
Fittings[9]	9,500.00	1,743.12	10,000.00	1,522.07	9,500.00	1,717.90	10,000.00	1,497.01	9,500.00	1,552.29
Wharfage[10]	73.92	73.92	240.58	240.58	73.92	73.92	240.58	240.58	73.92	73.92
Trimming[11]	2,282.69	2,282.69	1,081.22	1,081.22	2,282.69	2,282.69	829.22	829.22	2,282.69	2,282.69
Tolls[12]	4,759.50	4,759.50	8,400.00	8,400.00	4,759.50	4,759.50	8,400.00	8,400.00	4,759.50	4,759.50
Tug service[13]	685.20	685.20	(14)	(14)	751.16	751.16	(14)	(14)	850.60	850.60
Pilot service[13]	516.90	1,033.80	(14)	(14)	500.32	1,000.65	(14)	(14)	409.37	818.75
Total operating and other expenses per trip...dollars	61,103.49	83,067.39	89,078.17	127,736.62	60,593.66	81,956.57	87,860.92	125,528.88	57,029.91	74,564.02
Cost of transporting fill-out cargo, origin to Montreal[15]...dollars	4,045.74	4,045.74	13,124.26	13,124.26	3,812.17	3,812.17	12,366.56	12,366.56	2,577.13	2,577.13
Total costs...dollars	65,149.23	87,113.13	102,202.43	140,860.88	64,405.83	85,768.74	100,227.48	137,895.44	59,607.04	77,141.15
Per bushel...cents	18.37	24.57	15.01	20.68	18.16	24.18	14.72	20.25	16.81	21.75
Per gross ton...dollars	6.86	9.17	5.60	7.72	6.78	9.03	5.49	7.55	6.27	8.12

See footnotes at end of table.

TABLE 61.--Comparative estimated one-way and round-trip costs for transporting grain between selected United States ports and Rotterdam, Netherlands, in a Liberty-type vessel and in a lake-ocean bulk carrier, 1957[1]--Continued

Voyage particulars	Toledo, Ohio--Continued		Baltimore, Maryland				New Orleans, Louisiana			
	Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier	
	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]
Distance, nautical miles[4]	3,657	7,314	3,684	7,368	3,684	7,368	4,820	9,640	4,820	9,640
Voyage time:										
At sea, plus 1 day[5]...days	12.50	25.10	14.45	28.91	11.87	23.74	18.76	37.52	15.37	30.75
In port...days[6]	8.00	8.00	9.00	9.00	7.00	7.00	9.00	9.00	7.00	7.00
Total voyage time, days	20.50	33.10	23.45	37.91	18.87	30.74	27.76	46.52	22.37	37.75
Trips per navigation season[7]	---	7.40	---	9.10	---	11.22	---	7.42	---	9.14
Vessel capacity per trip at 25 1/2-foot draft:										
Bushels	560,000	560,000	---	---	---	---	---	---	---	---
Gross tons	15,000	15,000	---	---	---	---	---	---	---	---
Vessel capacity per trip at full draft:										
Bushels	681,000	681,000	354,600	354,600	681,000	681,000	354,600	354,600	681,000	681,000
Gross tons	18,255	18,255	9,500	9,500	18,255	18,255	9,500	9,500	18,255	18,255
Operating expenses per day:[8]										
At sea...dollars	3,217.50	3,217.50	1,699.27	1,669.27	3,217.50	3,217.50	1,669.27	1,669.27	3,217.50	3,217.50
In port...dollars	2,777.50	2,777.50	1,408.14	1,408.14	2,777.50	2,777.50	1,408.14	1,408.14	2,777.50	2,777.50
Operating expenses per trip...dollars	62,594.62	102,979.08	36,802.56	60,931.86	57,634.22	95,825.80	43,988.76	75,304.27	68,911.56	118,380.44
Other expenses per trip...dollars:										
Fittings[9]	10,000.00	1,351.35	7,350.00	807.69	3,000.00	267.38	10,933.00	1,473.45	3,000.00	328.23
Wharfage[10]	240.58	240.58	---	---	---	---	143.82	143.82	292.00	292.00
Trimming[11]	1,333.22	1,333.22	3,705.00	3,705.00	7,115.00	7,115.00	3,705.00	3,705.00	5,473.00	5,473.00
Tolls[12]	8,400.00	8,400.00	---	---	---	---	---	---	---	---
Tug service[13]	(14)	(14)	554.00	554.00	(14)	(14)	240.00	240.00	(14)	(14)
Pilot service[13]	(14)	(14)	238.00	320.50	(14)	(14)	119.71	183.46	(14)	(14)
Total operating and other expenses per trip...dollars	82,568.42	114,304.23	48,649.56	66,319.05	67,749.22	103,208.18	59,130.29	81,050.00	77,676.56	124,473.67
Cost of transporting fill-out cargo, origin to Montreal[15]...dollars	8,360.13	8,360.13	---	---	---	---	---	---	---	---
Total costs...dollars	90,928.55	122,664.36	48,649.56	66,319.05	67,749.22	103,208.18	59,130.29	81,050.00	77,676.56	124,473.67
Per bushel...cents	13.35	18.01	13.72	18.70	9.95	15.16	16.68	22.86	11.41	18.28
Per gross ton...dollars	4.98	6.72	5.12	6.98	3.71	5.65	6.22	8.53	4.25	6.82

[1] Costs are computed f.o.b. vessel at port of destination for grain requiring 46.5 cubic feet of stowage per gross ton and weighing 60 pounds per bushel. For vessel particulars see table 22.

[2] Voyage costs for the one-way trip are allocated to the one-way grain cargo movement. It is assumed that the vessel will have a return payload to cover the return voyage costs.

[3] Voyage costs for the round-trip are allocated to the one-way grain cargo movement. It is assumed that the vessel will have no return payload and that the one-way grain movement payload must cover round-trip costs.

[4] From table 62.

[5] The extra day at sea is to cover any unforeseen delays.

[6] It is assumed that the lake-ocean bulk carrier will require less time to load and discharge bulk cargo than the conventional Liberty-type vessel. Vessels calling at Montreal will require additional time to take on fill-out cargo to bring the vessel down to full ocean draft. Therefore, it is assumed that on direct shipments from the deep New Orleans and Baltimore harbors one less day will be spent in port than on similar full cargo movements from the St. Lawrence.

[7] The navigation season for the Great Lakes-St. Lawrence waterway route is assumed to be 245 days, table 21 (average, 1945-56). A 345-day navigation season applies to other routes, 20 days per year being reserved for vessel repairs and maintenance. The study assumes that vessels operating on the Great Lakes-St. Lawrence waterway route will find employment elsewhere during the non-navigable period on that waterway.

[8] From tables 28 and 29.

[9] The round-trip costs include grain fittings expenses prorated on the basis of the number of round trips per navigation season between origin and destination. Total fittings expenses are allocated to the single trips in the one-way costs. For Liberty vessels, fittings costs are shown in table 56. The cost of fittings for the lake-ocean bulk carrier are estimated as $10,000 for less than full cargo movements and as $3,000 for full cargo movements.

[10] Wharfage expenses accrue at Montreal when the vessel is in that port taking fill-out cargo. For wharfage and dockage expenses, see table 59.

[11] As applicable, the trimming expenses cover those stevedoring charges accruing at origin and at Montreal. For stevedoring charges see table 26.

[12] The assumed toll charge for passage through the St. Lawrence Seaway is 1 1/2 cents per bushel. The round-trip costs do not include any additional toll for the returning vessel in ballast. It is assumed that any toll that may be charged will be nominal. Its exclusion should have little or no affect on the overall analysis.

[13] For tug and pilot service charges see table 51.

[14] Tug and pilot service charges are included in the vessel operating expenses per day figures, tables 28 and 29.

[15] The fill-out cargo costs are computed on the basis of per-bushel costs for moving the required quantity of fill-out grain from the Great Lakes origin to Montreal in an "upper laker" type vessel, see table 50.

TABLE 62.--Distances in nautical miles

Origin	Destination							
	Baltimore, Md., U.S.A.	Boston, Mass., U.S.A.	Casablanca, Morocco	New York City, N. Y., U.S.A.	Rotterdam, Netherlands	Santos, Brazil	Savannah, Ga., U.S.A.	Wilmington, N. C., U.S.A.
Montreal, Canada...	---	---	3,329	---	3,135	5,544	---	---
Seven Islands, Canada.....	---	---	2,909	---	2,715	5,124	---	---
Duluth, Minn.....	2,927	2,406	4,487	2,618	4,293	6,702	3,171	3,069
Chicago, Ill.....	2,848	2,327	4,408	2,539	4,214	6,623	3,092	2,990
Toledo, Ohio.....	2,291	1,770	3,851	1,981	3,657	6,066	2,535	2,433
New York, N. Y.....	---	---	3,160	---	3,376	4,957	---	---
Baltimore, Md.....	---	---	3,632	---	3,684	5,031	---	---
New Orleans, La....	1,626	1,932	4,714	1,708	4,820	5,373	1,136	1,259
Portland, Oreg.....	---	---	8,386	---	8,711	8,478	---	---

U. S. Lake Survey Bulletin, Lake Series No. 5, Port of Toledo, Ohio, Corps of Engineers, Dept. of Army, p. 65; St. Lawrence Seaway, Hearings before the Committee on Public Works, House of Representatives, 82d Congress, 1st Session, Part 1 (HR 2536, Pt. 1); Table of Distances between Ports, Hydrographic Office, U. S. Navy Dept., 1943.

TABLE 63.--Estimated costs in cents per bushel for transporting wheat and soybeans between selected ports in a Liberty-type vessel and in a lake-ocean bulk carrier[1]

Origin	Casablanca, Morocco				Rotterdam, Netherlands				Santos, Brazil			
	Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier	
	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.[4].....	18.72	25.28	15.30	21.27	18.37	24.57	15.01	20.68	22.67	33.36	18.53	27.81
Chicago, Ill.[4].....	18.51	24.90	15.00	20.82	18.16	24.18	14.72	20.25	22.46	32.98	18.23	27.36
Toledo, Ohio[4].....	17.16	22.46	13.63	18.58	16.81	21.75	13.35	18.01	21.21	30.55	16.86	25.12
New Orleans, La.....	16.50	22.47	11.25	17.97	16.68	22.86	11.41	18.28	17.68	24.86	12.21	19.90
Montreal, P. Q., Can..	13.63	17.52	8.76	13.46	13.28	16.81	8.48	12.89	17.57	25.60	11.99	19.95
Seven Islands, P. Q., Can.....	12.86	15.96	8.15	12.23	12.52	15.52	7.87	11.66	16.81	24.04	11.38	18.72
New York, N. Y.....	15.13	17.96	10.29	14.72	15.52	18.74	10.60	15.36	18.33	24.49	12.91	19.98
Baltimore, Md.....	13.63	18.52	9.87	15.00	13.72	18.70	9.95	15.16	16.12	23.57	11.91	19.09
Portland, Oreg.....	23.43	37.71	18.07	31.33	24.01	39.11	18.55	32.28	24.58	40.04	18.21	31.60

[1] Costs are computed f.o.b. vessel at port of destination for grain requiring 46.5 cubic feet of stowage per gross ton. The costs include: Interest, depreciation, administration and supervision, wages and allowances, subsistence, stores, supplies, equipment, maintenance and repairs, fuel, hull and machinery and protection and indemnity insurance, grain fittings, (table 56), tolls, pilotage, profit, and the following charges at origin and at the intermediate cargo fill-out port, Montreal, as applicable: trimming, wharfage, and tug service. Cargo insurance, taxes, elevation charges, and the grain discharging expenses at destination are not included. For vessel particulars, see table 22.

[2] Voyage expenses for the one-way trip are allocated to the one-way grain cargo movement. For cost computation examples, see table 61.

[3] Voyage expenses for the round-trip are allocated to the one-way grain cargo movement. For cost computation examples, see table 61.

[4] Fill-out grain cargo is added at Montreal. It is assumed that the full grain cargo moves from the same origin, the fill-out portion of the cargo moving in an "upper laker" type vessel. The transportation costs in the "upper laker" vessel to Montreal are computed on the round-trip basis and are included in the one-way and round-trip costs. For costs of moving grain in the "upper laker" type vessel, see tables 52, 53, and 54.

TABLE 64.--Estimated costs in cents per bushel for transporting corn between selected ports in a Liberty-type vessel and in a lake-ocean bulk carrier[1]

Origin	Destination											
	Casablanca, Morocco				Rotterdam, Netherlands				Santos, Brazil			
	Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier	
	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.[4]	20.05	27.07	16.39	22.78	19.67	26.31	16.08	22.15	24.28	35.73	19.85	29.78
Chicago, Ill.[4]	19.82	26.67	16.07	22.30	19.45	25.90	15.77	21.69	24.05	35.32	19.52	29.30
Toledo, Ohio[4]	18.38	24.05	14.60	19.90	18.00	23.29	14.30	19.29	22.72	32.72	18.06	26.90
New Orleans, La.	17.67	24.07	12.05	19.25	17.86	24.48	12.22	19.58	18.94	26.63	13.08	21.31
Montreal, P. Q., Can.	14.60	18.76	9.38	14.42	14.22	18.00	9.08	13.81	18.82	27.42	12.84	21.37
Seven Islands, P. Q., Can.	13.77	17.09	8.73	13.10	13.41	16.33	8.43	12.49	18.00	25.75	12.19	20.05
New York, N. Y.	16.20	19.24	11.02	15.27	16.62	20.07	11.35	16.45	19.63	26.23	13.83	21.40
Baltimore, Md.	14.60	19.83	10.57	16.07	14.69	20.03	10.66	16.24	17.26	25.24	12.76	20.45
Portland, Oreg.	25.09	40.39	19.35	33.55	25.71	41.89	19.87	34.57	26.33	42.88	19.50	33.84

[1] Costs are computed f.o.b. vessel at port of destination. Corn requires 49.8 cubic feet of stowage per gross ton or 107.1 percent of that (46.5 cubic feet) required for wheat and soybeans. The transportation costs for wheat and soybeans, table 63, were multiplied by 107.1 percent to determine the transportation costs for the movement of corn. For vessel particulars, see table 22.
[2] Voyage expenses for the one-way trip are allocated to the one-way grain cargo movement. For cost computation examples, see table 61.
[3] Voyage expenses for the round-trip are allocated to the one-way grain cargo movement. For cost computation examples, see table 61.
[4] Fill-out grain cargo is added at Montreal. It is assumed that the full grain cargo moves from the same origin, the fill-out portion of the cargo moving in an "upper laker" type vessel, see tables 52, 53, and 54.

TABLE 65.--Estimated costs in cents per bushel for transporting barley between selected ports in a Liberty-type vessel and in a lake-ocean bulk carrier[1]

Origin	Destination											
	Casablanca, Morocco				Rotterdam, Netherlands				Santos, Brazil			
	Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier	
	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.[4]	23.38	31.57	19.11	26.57	22.94	30.69	18.75	25.83	28.31	41.67	23.14	34.73
Chicago, Ill.[4]	23.12	31.10	18.74	26.00	22.68	30.20	18.39	25.29	28.05	41.19	22.77	34.17
Toledo, Ohio[4]	21.43	28.05	17.02	23.21	21.00	27.17	16.67	22.49	26.49	38.16	21.06	31.37
New Orleans, La.	20.61	28.07	14.05	22.44	20.83	28.55	14.25	22.83	22.08	31.05	15.25	24.86
Montreal, P. Q., Can.	17.02	21.88	10.94	16.81	16.59	21.00	10.59	16.10	21.94	31.97	14.98	24.92
Seven Islands, P. Q., Can.	16.06	19.93	10.18	15.28	15.64	19.05	9.83	14.56	21.00	30.03	14.21	23.38
New York, N. Y.	18.90	22.43	12.85	18.39	19.38	23.41	13.24	19.18	22.89	30.59	16.12	24.96
Baltimore, Md.	17.02	23.13	12.33	18.74	17.14	23.36	12.43	18.93	20.13	29.44	14.88	23.84
Portland, Oreg.	29.26	47.10	22.57	39.13	29.99	48.85	23.17	40.32	30.70	50.01	22.74	39.47

[1] Costs are computed f.o.b. vessel at port of destination. Barley requires 58.1 cubic feet of stowage per gross ton or 124.9 percent of that (46.5 cubic feet) required for wheat and soybeans. The transportation costs for wheat and soybeans, table 63, were multiplied by 124.9 percent to determine the transportation costs for the movement of barley. For vessel particulars see table 22.
[2] Voyage expenses for the one-way trip are allocated to the one-way grain cargo movement. For cost computation examples, see table 61.
[3] Voyage expenses for the round-trip are allocated to the one-way grain cargo movement. For cost computation examples, see table 61.
[4] Fill-out grain cargo is added at Montreal. It is assumed that the full grain cargo moves from the same origin, the fill-out portion of the cargo moving in an "upper laker" type vessel, see tables 52, 53, and 54.

TABLE 66. --Comparative transportation and handling costs in cents per bushel for grain and soybeans between ports on the Great Lakes and foreign destinations via selected all-water routings over the Great Lakes-St. Lawrence waterway with overseas movement in a Liberty-type vessel[1]

Type of vessel and origin	Commodity	Destination					
		Casablanca, Morocco		Rotterdam, Netherlands		Santos, Brazil	
		One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Liberty vessel, origin to destination:[4]							
Duluth, Minn.	Wheat and soybeans	21.779	28.339	21.429	27.629	25.729	36.419
	Corn	23.109	30.129	22.729	29.369	27.339	38.789
	Barley	26.439	34.629	25.999	33.749	31.369	44.729
Chicago, Ill.	Wheat and soybeans	21.579	27.969	21.229	27.249	25.529	36.049
	Corn	22.889	29.739	22.519	28.969	27.119	38.389
	Barley	26.189	34.169	25.749	33.269	31.119	44.259
Toledo, Ohio	Wheat and soybeans	19.942	25.242	19.592	24.532	23.992	33.332
	Corn	21.162	26.832	20.782	26.072	25.502	35.502
	Barley	24.212	30.832	23.782	29.952	29.272	40.942
Upper laker to Montreal, Canada-Liberty vessel beyond:[5]							
Duluth, Minn.	Wheat and soybeans	26.184	34.174	25.834	33.464	30.124	42.254
	Corn	27.634	36.184	27.254	35.424	31.854	44.844
	Barley	31.254	41.234	30.824	40.354	36.174	51.324
Chicago, Ill.	Wheat and soybeans	25.884	33.554	25.534	32.844	29.824	41.634
	Corn	27.314	35.524	26.934	34.764	31.534	44.184
	Barley	30.874	40.454	30.444	39.574	35.794	50.544
Toledo, Ohio	Wheat and soybeans	23.937	29.957	23.587	29.247	27.877	38.037
	Corn	25.247	31.687	24.867	30.927	29.467	40.347
	Barley	28.517	36.037	28.087	35.157	33.437	46.127
Upper laker to Seven Islands, Canada-Liberty vessel beyond:[5] [6]							
Duluth, Minn.	Wheat and soybeans	26.724	35.224	26.384	34.514	30.674	43.304
	Corn	28.204	37.314	27.844	36.554	32.434	45.974
	Barley	31.934	42.544	31.514	41.664	36.874	52.644
Chicago, Ill.	Wheat and soybeans	26.414	34.604	26.074	33.894	30.364	42.684
	Corn	27.874	36.644	27.514	35.884	32.104	45.304
	Barley	31.544	41.764	31.124	40.884	36.484	51.864
Toledo, Ohio	Wheat and soybeans	24.477	31.007	24.137	30.297	28.427	39.087
	Corn	25.817	32.817	25.457	32.057	30.047	41.477
	Barley	29.197	37.347	28.777	36.467	34.137	47.447

[1] The costs are computed f.o.b. vessel at port of destination. Included are the costs accruing to the vessel as well as the grain handling expenses - car to vessel at origin ports, and as applicable, the vessel to vessel grain handling expenses at forwarding elevators in either Montreal or in Seven Islands, see footnote 6 below and table 27. The costs include the estimated St. Lawrence Seaway toll of 1 1/2 cents per bushel.

[2] Included are all costs and grain handling expenses for a one-way grain movement in the designated vessel or vessels. It is assumed the vessels have return payload to the ports of origin.

[3] Included are the costs for the round-trip plus the grain handling expenses at origin ports, and as applicable at forwarding elevators in Montreal or in Seven Islands, see footnote below. All costs have been allocated to the one-way grain movement. It is assumed that the vessel or vessels return without payload to the forwarding port or to the port of origin.

[4] Channel depths limit the amount of grain cargo in the Liberty-type vessel and fill-out cargo is added at Montreal. This fill-out cargo is assumed to move in an "upper laker" vessel from the same origin, and the costs of this movement are computed on a round-trip basis. See tables 52, 53, and 54. For vessel particulars see table 22. For vessel transportation cost computations, see tables 50 and 61.

[5] In these computations the ocean-going vessel loads a full cargo of grain at the St. Lawrence port, either Montreal or Seven Islands. The grain is transported to these ports in an upper laker type vessel.

[6] Grain elevator facilities are not available at Seven Islands. However, because there is an anticipated large volume movement of iron ore from that port to ports on the Great Lakes, grain elevation facilities have been proposed to make use of returning vessel cargo capacity.

TABLE 67. --Comparative transportation and handling costs in cents per bushel for grain and soybeans between ports on the Great Lakes and foreign destinations via selected all-water routings over the Great Lakes-St. Lawrence waterway with overseas movement in a lake-ocean bulk carrier [1]

Type of vessel and origin	Commodity	Destination					
		Casablanca, Morocco		Rotterdam, Netherlands		Santos, Brazil	
		One-way [2]	Round-trip [3]	One-way [2]	Round-trip [3]	One-way [2]	Round-trip [3]
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Lake-ocean bulk carrier, origin to destination: [4]							
Duluth, Minn.	Wheat and soybeans	18.539	24.329	18.069	23.739	21.589	30.869
	Corn	19.449	25.839	19.139	25.209	22.909	32.839
	Barley	22.169	29.629	21.809	28.889	26.199	37.789
Chicago, Ill.	Wheat and soybeans	18.069	23.889	17.789	23.319	21.299	30.429
	Corn	19.139	25.369	18.839	24.759	22.589	32.369
	Barley	21.809	29.069	21.459	22.072	25.839	37.239
Toledo, Ohio	Wheat and soybeans	16.412	21.362	16.132	20.792	19.642	27.902
	Corn	17.382	22.682	17.082	22.072	20.842	29.682
	Barley	19.802	25.992	19.452	25.272	23.842	34.152
Upper laker to Montreal, Canada-Lake-ocean bulk carrier beyond: [5]							
Duluth, Minn.	Wheat and soybeans	21.314	30.114	21.034	29.544	24.544	36.604
	Corn	22.414	31.844	22.114	31.234	25.874	38.794
	Barley	25.174	36.164	24.824	35.454	29.214	44.274
Chicago, Ill.	Wheat and soybeans	21.014	29.494	20.734	28.924	24.244	35.984
	Corn	22.094	31.184	21.794	30.574	25.554	38.134
	Barley	24.794	35.384	24.444	34.674	28.834	43.494
Toledo, Ohio	Wheat and soybeans	19.067	25.897	18.787	25.327	22.297	32.387
	Corn	20.027	27.347	19.727	26.737	23.487	34.297
	Barley	22.437	30.967	22.087	30.257	26.477	39.077
Upper laker to Seven Islands, Canada-Lake-ocean bulk carrier beyond: [5] [6]							
Duluth, Minn.	Wheat and soybeans	22.014	31.494	21.734	30.924	25.244	37.984
	Corn	23.164	33.324	22.864	32.714	26.624	40.274
	Barley	26.054	37.894	25.704	37.174	30.084	45.994
Chicago, Ill.	Wheat and soybeans	21.704	30.874	21.424	30.304	24.934	37.364
	Corn	22.834	32.654	22.534	32.044	26.294	39.604
	Barley	25.664	37.114	25.314	36.394	29.694	45.214
Toledo, Ohio	Wheat and soybeans	19.767	27.277	19.487	26.707	22.997	33.767
	Corn	20.777	28.827	20.477	28.217	24.239	35.777
	Barley	23.317	32.697	22.967	31.977	27.347	40.797

[1] The costs are computed f.o.b. vessel at port of destination. Included are the costs accruing to the vessel as well as the grain handling expenses - car to vessel at origin ports, and as applicable, the vessel to vessel grain handling expenses at forwarding elevators in either Montreal or in Seven Islands, see footnote 6 below and table 27. The costs include the estimated St. Lawrence Seaway toll of 1 1/2 cents per bushel. For vessel particulars see table 22. For vessel transportation cost computations, see tables 50 and 61.

[2] Included are all costs and grain handling expenses for a 1-way grain movement in the designated vessel or vessels. It is assumed the vessels have return payload to the ports of origin.

[3] Included are the vessel costs for the round-trip plus the grain handling expenses at origin ports, and as applicable at forwarding elevators in Montreal or in Seven Islands. All costs have been allocated to the one-way grain movement. It is assumed that the vessel or vessels return without payload to the forwarding port or to the port of origin.

[4] Channel depths limit the amount of grain cargo in the lake-ocean bulk carrier and fill-out cargo is added at Montreal. This fill-out cargo is assumed to move in an "upper laker" vessel from the same origin, and the costs of this movement are computed on a round-trip basis (see below for explanation), see tables 52, 53, and 54.

[5] In these computations the ocean going vessel loads a full cargo of grain at the St. Lawrence port, either Montreal or Seven Islands. The grain is transported to these ports in an upper laker type vessel.

[6] Grain elevator facilities are not available at Seven Islands. However, because there is an anticipated large volume movement of iron ore from that port to ports on the Great Lakes, grain elevation facilities have been proposed to make use of returning vessel cargo capacity.

TABLE 68.--Comparative estimated one-way and round-trip costs for transporting grain between selected United States ports and Baltimore, Md., in a Liberty-type vessel and in a lake-ocean bulk cargo vessel, 1957[1]

Voyage particulars	Ports of origin and vessel															
	Duluth, Minnesota				Chicago, Illinois				Toledo, Ohio				New Orleans, Louisiana			
	Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier	
	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]
Distance[4].....nautical miles	2,927	5,854	2,927	5,854	2,848	5,696	2,848	5,696	2,291	4,582	2,291	4,582	1,626	3,252	1,626	3,252
Voyage time:																
At sea plus 1 day[5]....days	12.30	24.60	10.45	20.90	12.00	24.00	10.15	20.30	9.85	19.70	8.35	16.70	6.66	13.32	5.52	11.04
In port.....days[6]	10.00	10.00	8.00	8.00	10.00	10.00	8.00	8.00	10.00	10.00	8.00	8.00	9.00	9.00	7.00	7.00
Total voyage time.....days	22.30	34.60	18.45	28.90	2.00	34.00	18.15	28.30	19.85	29.70	16.35	24.70	15.66	22.32	12.52	18.04
Trips per navigation season[7]	---	7.08	---	8.48	---	7.21	---	8.66	---	8.25	---	9.92	---	15.46	---	19.12
Vessel capacity per trip at 25-1/2-foot draft:																
Bushels.....	317,300	317,300	560,000	560,000	317,300	317,300	560,000	560,000	317,300	317,300	560,000	560,000	317,300	317,300	560,000	560,000
Gross tons.....	8,500	8,500	15,000	15,000	8,500	8,500	15,000	15,000	8,500	8,500	15,000	15,000	8,500	8,500	15,000	15,000
Vessel capacity per trip at full draft:																
Bushels.....	354,600	354,600	681,000	681,000	354,600	354,600	681,000	681,000	354,600	354,600	681,000	681,000	354,600	354,600	681,000	681,000
Gross tons.....	9,500	9,500	18,255	18,255	9,500	9,500	18,255	18,255	9,500	9,500	18,255	18,255	9,500	9,500	18,255	18,255
Operating expenses per day:[8]																
At sea.....dollars	2,481.41	2,481.41	4,284.50	4,284.50	2,481.41	2,481.41	4,284.50	4,284.50	2,481.41	2,481.41	4,284.50	4,284.50	2,481.41	2,481.41	4,284.50	4,284.50
In port.....dollars	2,079.67	2,079.67	3,606.90	3,606.90	2,079.67	2,079.67	3,606.90	3,606.90	2,079.67	2,079.67	3,606.90	3,606.90	2,079.67	2,079.67	3,606.90	3,606.90
Operating expenses per trip.....dollars	51,318.04	81,839.39	73,628.22	118,401.25	50,573.62	80,350.54	62,342.87	115,830.55	45,238.59	69,680.48	64,630.77	100,406.35	35,243.22	51,769.41	48,898.74	72,549.18
Other expenses per trip.....dollars																
Fittings[9].....	9,500.00	1,341.81	10,000.00	1,179.24	9,500.00	1,317.61	10,000.00	1,154.73	9,500.00	1,151.52	10,000.00	1,008.06	10,933.00	707.18	3,000.00	156.90
Wharfage[10].....	73.92	73.92	240.58	240.58	73.92	73.92	240.58	240.58	73.92	73.92	240.58	240.58	143.82	143.82	292.00	292.00
Trimming[11].....	2,282.69	2,282.69	1,081.22	1,081.22	2,282.69	2,282.69	829.22	829.22	2,282.69	2,282.69	1,333.22	1,333.22	3,705.00	3,705.00	5,473.00	5,473.00
Tolls[12].....	4,759.50	4,759.50	8,400.00	8,400.00	4,759.50	4,759.50	8,400.00	8,400.00	4,759.50	4,759.50	8,400.00	8,400.00	---	---	---	---
Tug service[13].....	685.20	685.20	(14)	(14)	751.16	751.16	(14)	(14)	850.60	850.60	(14)	(14)	240.00	240.00	(14)	(14)
Pilot service[13].....	516.90	1,033.80	(14)	(14)	500.32	1,000.65	(14)	(14)	409.37	818.75	(14)	(14)	119.71	183.46	(14)	(14)
Total operating and other expenses per trip..dollars	69,136.25	92,016.31	93,350.02	129,302.29	68,441.21	90,536.07	91,812.67	126,455.08	63,114.67	79,617.46	84,604.57	111,388.21	50,384.75	56,748.87	57,663.74	78,471.08
Cost of transporting fill-out cargo, origin to Montreal.....dollars[15]	4,045.74	4,045.74	13,124.26	13,124.26	3,812.17	3,812.17	12,366.56	12,366.56	2,577.13	2,577.13	8,360.13	8,360.13	---	---	---	---
Total costs.....dollars	73,181.99	96,062.05	106,474.28	142,426.55	72,253.38	94,348.24	104,179.23	138,821.64	65,691.80	82,194.59	92,964.70	119,748.34	50,384.75	56,748.87	57,663.74	78,471.08
Per bushel.....cents	20.64	27.09	15.63	20.91	20.38	26.61	15.30	20.38	18.53	23.18	13.65	17.58	14.21	16.00	8.47	11.52
Per gross ton.....dollars	7.70	10.11	5.83	7.80	7.61	9.93	5.71	7.60	6.91	8.65	5.09	6.56	5.30	5.97	3.16	4.30

[1] Costs are computed f.o.b. vessel at port of destination for grain requiring 46.5 cubic feet of stowage per gross ton and weighing 60 pounds per bushel. For estimated port, stevedoring, and other charges incidental to grain discharging at U. S. Atlantic Coast ports, see table 60, and for vessel particulars, see table 22.

[2] Voyage costs for the one-way trip are allocated to the one-way grain cargo movement. It is assumed that the vessel has a return payload to cover the costs of the return voyage.

[3] Voyage costs for the round-trip are allocated to the one-way grain cargo movement. It is assumed that the vessel will have no return payload and that the one-way grain movement payload must cover all round-trip costs.

[4] From table 62.

[5] The extra day at sea is to cover any unforeseen delays.

[6] It is assumed that the lake-ocean bulk carrier will require less time to load and to discharge bulk cargo than the conventional Liberty-type vessel. Vessels calling at Montreal will require additional time to take on fill-out cargo. Therefore, it is assumed that on direct shipments from the deep New Orleans and Baltimore harbors one less day will be spent in port than on similar full cargo movements from the St. Lawrence.

[7] The navigation season for the Great Lakes-St. Lawrence waterway route is assumed to be 245 days, table 21 (average 1945-56). A 345-day navigation season applies to other routes, 20 days per year being reserved for vessel repairs and maintenance. The study assumes that vessels operating on the Great Lakes-St. Lawrence waterway route will find employment elsewhere during the non-navigable period on that waterway.

[8] From tables 28 and 29.

[9] The round-trip costs include grain fittings expenses prorated on the basis of the number of round trips per navigation season between origin and destination. Total fittings expenses are allocated to the single trips in the one-way costs. For Liberty vessels, fittings costs are shown in table 56. The cost of fittings for the lake-ocean bulk carrier are estimated as $10,000 for less than full cargo movements and as $3,000 for full cargo movements.

[10] Wharfage expenses accrue at Montreal when the vessel is in that port taking on fill-out cargo. For wharfage and dockage expenses, see table 59.

[11] As applicable, the trimming expenses cover those stevedoring charges accruing at origin and at Montreal. For stevedoring charges see table 26.

[12] The assumed toll charge for passage through the St. Lawrence Seaway is 1-1/2 cents per bushel. The round-trip costs do not include any additional toll for the returning vessel in ballast. It is assumed that any toll that may be charged will be nominal. Its exclusion should have little or no effect on the overall analysis.

[13] For tug and pilot service charges see table 51.

[14] Tug and pilot service charges are included in the vessel operating expenses per day figures, tables 28 and 29.

[15] The fill-out cargo costs are computed on the basis of per-bushel costs for moving the required quantity of fill-out grain from the Great Lakes origin to Montreal in an "upper laker" type vessel, see tables 52, 53 and 54.

TABLE 69.--Estimated costs in cents per bushel for transporting wheat and soybeans between selected U.S. ports in a Liberty-type vessel and in a lake-ocean bulk carrier[1]

Origin	Destination																			
	Baltimore, Md., U.S.A.				Boston, Mass., U.S.A.				New York, N. Y., U.S.A.				Savannah, Ga., U.S.A.				Wilmington, N. C., U.S.A.			
	Liberty vessel		Lake-ocean bulk-carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier	
	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.[4]	20.64	27.09	15.63	20.91	19.28	24.34	14.62	18.87	19.83	25.46	15.04	19.71	21.30	28.43	16.11	21.87	21.03	27.89	15.91	21.47
Chicago, Ill.[4]	20.38	26.61	15.30	20.38	18.98	23.76	14.26	18.29	19.54	24.90	14.67	19.11	21.01	27.89	15.76	21.31	20.74	27.35	15.55	20.89
Toledo, Ohio[4]	18.53	23.18	13.65	17.58	17.14	20.37	12.62	15.51	17.69	21.47	13.02	16.31	19.16	24.46	13.30	18.51	18.88	23.89	13.90	18.09
New Orleans, La.	14.21	16.00	8.47	11.52	15.04	17.65	9.06	12.71	14.44	16.44	8.62	11.84	12.93	13.37	7.51	9.61	13.25	14.03	7.75	10.09

[1] Costs are computed f.o.b. vessel at port at destination for grain requiring 46.5 cubic feet of stowage per gross ton. The costs include: Interest, depreciation, administration and supervision, wages and allowances, subsistence, stores, supplies, equipment, maintenance and repairs, fuel, hull and machinery and protection and indemnity insurance, grain fittings (table 56), tolls, pilotage, profit, and the following charges at origin and at the intermediate cargo fill-out port, Montreal, as applicable: trimming, wharfage and tug service. Cargo insurance, taxes, elevation charges, and the grain discharging expenses at destination are not included. For vessel particulars, see table 22.
[2] Voyage expenses for the one-way trip are allocated to the 1-way grain cargo movement. For cost computation examples, see table 68.
[3] Voyage expenses for the round-trip are allocated to the one-way grain cargo movement. For cost computation examples, see table 68.
[4] Fill-out grain cargo is added at Montreal. It is assumed that the full grain cargo moves from the same origin, the fill-out portion of the cargo moving in an "upper laker" type vessel. The transportation costs in the "upper laker" vessel to Montreal are computed on the round-trip basis and are included in the one-way and round-trip costs. For costs of moving grain in the "upper laker" type vessel, see tables 52, 53, and 54.

TABLE 70.--Estimated costs in cents per bushel for transporting corn between selected U.S. ports in a Liberty-type vessel and in a lake-ocean bulk carrier[1]

Origin	Destination																			
	Baltimore, Md., U.S.A.				Boston, Mass., U.S.A.				New York, N. Y., U.S.A.				Savannah, Ga., U.S.A.				Wilmington, N. C., U.S.A.			
	Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier	
	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.[4]	22.11	29.01	16.74	22.39	20.65	26.07	15.66	20.21	21.24	27.27	16.11	21.11	22.81	30.45	17.25	23.42	22.52	29.87	17.04	22.99
Chicago, Ill.[4]	21.83	28.50	16.39	21.83	20.33	25.45	15.27	19.59	20.93	26.67	15.71	20.47	22.50	29.87	16.88	22.82	22.21	29.29	16.65	22.37
Toledo, Ohio[4]	19.85	24.83	14.62	18.83	18.36	21.82	13.52	16.61	18.95	22.99	13.94	17.47	20.52	26.20	14.24	19.82	20.22	25.59	14.89	19.37
New Orleans, La.	15.22	17.14	9.07	12.34	16.11	18.90	9.70	13.61	15.47	17.61	9.23	12.68	13.85	14.32	8.04	10.29	14.19	15.03	8.30	10.81

[1] Costs are computed f.o.b. vessel at port of destination. Corn requires 49.8 cubic feet of stowage per gross ton or 107.1 percent of that (46.5 cubic feet) required for wheat and soybeans. The transportation costs for wheat and soybeans, table 69, were multiplied by 107.1 percent to determine the transportation costs for the movement of corn. For vessel particulars, see table 22.
[2] Voyage expenses for the one-way trip are allocated to the one-way grain cargo movement. For cost computation examples, see table 68.
[3] Voyage expenses for the round-trip are allocated to the one-way grain cargo movement. For cost computation examples, see table 68.
[4] Fill-out grain cargo is added at Montreal. It is assumed that the full grain cargo moves from the same origin, the fill-out portion of the cargo moving in an "upper laker" type vessel, see tables 52, 53, and 54.

TABLE 71.--Estimated costs in cents per bushel for transporting barley between selected ports in a Liberty-type vessel and in a lake-ocean bulk carrier [1]

Origin	Destination																			
	Baltimore, Md., U.S.A.				Boston, Mass., U.S.A.				New York, N. Y., U.S.A.				Savannah, Ga., U.S.A.				Wilmington, N. C., U.S.A.			
	Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier		Liberty vessel		Lake-ocean bulk carrier	
	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]	One-way[2]	Round-trip[3]
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.[4]	25.78	33.84	19.52	26.12	24.08	30.40	18.26	23.57	24.77	31.80	18.78	24.62	26.60	35.51	20.12	27.32	26.27	34.83	19.87	26.82
Chicago, Ill.[4]	25.45	33.24	19.11	25.45	23.71	29.68	17.81	22.84	24.41	31.10	18.32	23.87	26.24	34.83	19.68	26.62	25.90	34.16	19.42	26.09
Toledo, Ohio[4]	23.14	28.95	17.05	21.96	21.41	25.44	15.76	19.37	22.09	26.82	16.26	20.37	23.93	30.55	16.61	23.12	23.58	29.84	17.36	22.59
New Orleans, La.	17.75	19.98	10.58	14.39	18.78	22.04	11.32	15.87	18.04	20.53	10.77	14.79	16.15	16.70	9.38	12.00	16.55	17.52	9.68	12.60

[1] Costs are computed f.o.b. vessel at port of destination. Barley requires 58.1 cubic feet of stowage per gross ton or 124.9 percent of that (46.5 cubic feet) required for wheat and soybeans. The transportation costs for wheat and soybeans, table 69, were multiplied by 124.9 percent to determine the transportation costs for the movement of barley. For vessel particulars see table 22.

[2] Voyage expenses for the one-way trip are allocated to the one-way grain cargo movement. For cost computation examples, see table 68.

[3] Voyage expenses for the round-trip are allocated to the one-way grain cargo movement. For cost computation examples, see table 68.

[4] Fill-out grain cargo is added at Montreal. It is assumed that the full grain cargo moves from the same origin, the fill-out portion of the cargo moving in an "upper laker" type vessel, see tables 52, 53, and 54.

TABLE 72. --Distances and average charter rates in cents per bushel for heavy grain between selected world port areas for the period, August through November 1957[1]

Origin port area	Destination port area							
	Antwerp-Rotterdam-Hamburg		Brazil		Morocco[2]		United Kingdom	
	Distance	Rate	Distance	Rate	Distance	Rate	Distance	Rate
	Miles	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*	*Miles*	*Cents*
U. S. Atlantic.....	3,530	13.7	4,994	[3] 18.2	3,396	16.8	3,373	16.7
U. S. Gulf.....	4,820	16.0	5,373	19.0	4,714	22.2	4,663	21.9
U. S. Pacific.....	8,711	17.7	8,478	21.3	8,386	22.4	8,554	22.8
St. Lawrence.....	3,135	13.5	5,544	[3] 20.1	3,329	14.3	2,978	15.9

[1] Distances are in nautical miles. For the St. Lawrence port area distances are computed from Montreal to Liverpool, Rotterdam, Casablanca, and Santos, respectively. For the U. S. Atlantic port area, average distances are computed from N. Y. City and Baltimore to the same foreign ports, respectively. New Orleans and Portland (Oreg.) are used as the origin ports for the U. S. Gulf and Pacific port areas to the above foreign ports.

Information regarding actual tramp charters for the August-November 1957 period is very limited due to the confidential nature of the information, as well as limited cargoes between some of the specific port areas. Some rates were furnished by Johnson & Dever, Limited, Montreal, P. Q., Can., and others were taken from the magazine publication, Fairplay. They are tramp charter rates f.o.b., vessel at port of destination. Rates are calculated on the basis of 60-pound bushels.

[2] Rates are estimated by the author in the absence of any known specific movement. Since the same tramp charter rates often apply for varying distances due to the rate blanketing practice, estimated rates to Morocco were based on rates for movements over comparable distances to either the United Kingdom or to the Antwerp-Rotterdam-Hamburg port group.

[3] In the absence of any known specific movements during the period covered by the above data, rates were estimated from the St. Lawrence and U. S. Atlantic port areas to Brazil. The estimates are based on actual charter rates from the U. S. Gulf.

TABLE 73.--Freight rates in U. S. cents per bushel for cargoes of heavy grain, 1953 through 1957

Month	From St. Lawrence to United Kingdom						From U. S. Atlantic to United Kingdom						From U. S. Gulf to United Kingdom						From North Pacific to United Kingdom					
	1953	1954	1955	1956	1957	Average	1953	1954	1955	1956	1957	Average	1953	1954	1955	1956	1957	Average	1953	1954	1955	1956	1957	Average
March	19.3	17.8	24.4	33.7	31.9	25.4	20.1	17.8	25.3	34.7	32.8	26.1	21.9	20.2	28.1	39.5	36.6	29.3	30.0	25.3	49.7	53.2	48.7	41.4
April	18.8	16.9	23.4	36.6	24.4	24.0	19.3	16.9	26.2	40.3	25.3	25.6	21.0	19.7	30.9	46.9	30.0	29.7	30.0	23.4	43.1	59.0	34.7	38.0
May	19.1	16.9	30.0	35.6	24.4	25.2	19.5	17.8	32.2	39.4	25.3	26.8	21.4	20.6	36.0	46.9	30.0	31.0	28.1	23.4	46.0	59.0	34.7	38.2
June	16.3	16.1	30.0	28.1	---	22.6	16.7	17.5	30.9	30.9	---	24.0	18.2	20.0	35.6	35.6	---	27.3	26.2	---	46.0	49.7	---	40.6
July	15.6	15.7	28.1	30.9	---	22.6	15.9	16.9	29.1	33.7	---	23.9	18.2	18.7	34.7	38.4	---	27.5	25.3	20.6	38.4	51.6	---	34.0
August	16.9	17.6	27.2	32.8	---	23.6	17.2	---	28.1	---	---	22.6	19.5	---	33.7	39.5	---	30.9	25.3	21.8	39.4	---	---	28.8
September	16.9	19.2	32.8	31.9	---	25.2	17.2	20.2	31.9	34.7	---	26.0	19.5	24.4	37.5	44.1	---	31.4	25.3	28.1	45.0	53.4	---	37.9
October	---	21.6	34.7	36.6	---	31.0	---	---	33.7	35.6	---	34.6	---	---	39.4	43.1	---	41.2	---	34.1	48.7	57.2	---	46.7
Average	17.6	17.7	28.8	33.3	---	---	18.0	17.8	29.7	35.6	---	---	20.0	20.6	34.5	41.7	---	---	27.2	25.2	44.5	54.7	---	---
	From St. Lawrence to Antwerp-Hamburg						From U. S. Atlantic to Antwerp-Hamburg						From U. S. Gulf to Antwerp-Hamburg						From North Pacific to Antwerp-Hamburg					
	1953	1954	1955	1956	1957	Average	1953	1954	1955	1956	1957	Average	1953	1954	1955	1956	1957	Average	1953	1954	1955	1956	1957	Average
March	17.4	15.0	20.6	28.1	[1] 26.8	21.6	16.1	15.0	21.6	29.4	28.1	22.0	18.7	17.8	24.4	33.5	32.8	25.4	28.1	23.4	45.0	47.5	44.1	37.6
April	16.1	14.1	20.1	34.8	[1] 21.4	21.3	16.7	14.1	21.4	36.2	22.1	22.1	18.1	16.9	24.0	42.9	28.1	26.0	28.1	21.6	37.5	52.5	31.9	34.3
May	17.2	14.1	26.2	32.8	21.4	22.3	17.8	15.0	28.5	34.8	22.1	23.6	18.4	18.3	32.2	42.2	28.1	27.8	26.2	21.6	39.4	52.5	31.9	34.3
June	14.1	14.1	25.3	24.8	---	19.6	14.7	---	26.2	25.4	---	22.1	16.1	19.2	30.0	29.5	---	23.7	24.4	---	39.4	45.0	---	36.3
July	14.1	13.5	24.4	28.8	---	20.2	14.7	14.6	25.3	29.5	---	21.0	16.1	16.9	30.9	35.5	---	24.8	23.4	19.5	33.4	46.0	---	30.6
August	14.1	16.9	23.4	26.1	---	20.1	14.7	---	24.4	28.1	---	22.4	16.1	20.6	30.0	37.5	---	26.0	23.4	20.0	34.7	47.5	---	31.4
September	14.1	16.9	28.1	29.5	---	22.1	14.7	17.8	28.1	30.4	---	22.7	16.1	22.5	31.9	40.2	---	27.7	23.4	26.2	40.3	44.2	---	33.5
October	---	21.4	30.0	28.8	---	26.7	---	18.9	29.1	30.1	---	26.0	---	22.6	33.7	38.8	---	31.7	---	28.1	44.1	48.9	---	40.4
Average	15.3	15.7	24.8	29.2	---	---	15.6	15.9	25.6	30.5	---	---	17.1	19.4	29.6	37.5	---	---	25.3	22.9	39.2	48.0	---	---

[1] Rate for Antwerp-Rotterdam.

World wheat Statistics, May 1957, The International Wheat Council, Haymarket House, Haymarket, London, pp. 70-71.

TABLE 74. --Freight rate differences for cargoes of heavy grain as related to rates from St. Lawrence, 1953-1956

(U. S. cents per bushel)

Period	To United Kingdom			To Antwerp-Hamburg		
	U. S. Atlantic	U. S. Gulf	Pacific	U. S. Atlantic	U. S. Gulf	Pacific
1953						
March	.8	2.6	10.7	-1.3	1.3	10.7
April	.5	2.2	11.2	.6	2.0	12.0
May	.4	2.3	9.0	.6	1.2	9.0
June	.4	1.9	9.9	.6	2.0	10.3
July	.3	2.6	9.7	.6	2.0	9.3
August	.3	2.6	8.4	.6	2.0	9.3
September	.3	2.6	8.4	.6	2.0	9.3
October	---	---	---	---	---	---
Average	.4	2.4	9.6	.3	1.8	10.0
1954						
March	.0	2.4	7.5	.0	2.8	8.4
April	.0	2.8	6.5	.0	2.8	7.5
May	.9	3.7	6.5	.9	4.2	7.5
June	1.4	3.9	---	---	5.1	---
July	1.2	3.0	4.9	1.1	3.4	6.0
August	---	---	4.2	---	3.7	3.1
September	1.0	5.2	8.9	.9	5.6	9.3
October	---	---	2.5	-2.5	1.2	6.7
Average	.7	3.5	5.9	.1	3.6	6.9
1955						
March	.9	3.7	25.3	1.0	3.8	24.4
April	2.8	7.5	19.7	1.3	3.9	17.4
May	2.2	6.0	16.0	2.3	6.0	13.2
June	.9	5.6	16.0	.9	4.7	14.1
July	1.0	6.6	10.3	.9	6.5	9.0
August	.9	6.5	12.2	1.0	6.6	11.3
September	-.9	4.7	12.2	.0	3.8	12.2
October	-1.0	4.7	14.0	-.9	3.7	14.1
Average	.9	5.7	15.7	.9	4.9	14.5
1956						
March	1.0	5.8	19.5	1.3	5.4	19.4
April	3.7	10.3	22.4	1.4	8.1	17.7
May	3.8	11.3	23.4	2.0	9.4	19.7
June	2.8	7.5	21.6	.6	4.7	20.2
July	2.8	7.5	20.7	.7	6.7	17.2
August	---	6.7	---	2.0	11.4	21.4
September	2.8	12.2	21.5	.9	10.7	14.7
October	-1.0	6.5	20.6	1.3	10.0	20.1
Average	2.4	8.5	21.4	1.2	8.3	18.8

World Wheat Statistics, May 1957, The International Wheat Council. Haymarket House, Haymarket, Lond, pp. 70, 71.

TABLE 75. --Wheat: Selected routings over which wheat can be moved from origin to port of export most economically (in cents per bushel)[1]

Origin of wheat, costs, charges	Duluth, Minn.			Chicago, Ill.			Toledo, Ohio			Baltimore, Md.			New Orleans, La.			New York, N. Y.		
	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Cincinnati, Ohio:																		
Costs	---	---	---	5.10	6.56	[3] 11.66	6.09	7.44	[4] 13.53	5.73	13.29	[4] 19.02	4.72	5.55	[3] 10.27	5.79	15.34	[4] 21.13
Charges	---	---	---	5.10	18.63	[3] 23.73	4.68	13.10	[5] 17.78	5.73	25.80	[4] 31.53	5.99	14.40	[4] 20.39	5.79	26.70	[4] 32.49
Columbus, Ohio:																		
Costs	---	---	---	---	---	---	5.82	6.28	[4] 12.10	5.47	11.99	[4] 17.46	---	---	---	5.53	14.27	[4] 19.80
Charges	---	---	---	---	---	---	4.68	9.50	[5] 14.18	5.47	25.80	[4] 31.27	---	---	---	5.53	26.70	[4] 32.23
Decatur, Ill.:																		
Costs	---	---	---	6.12	6.95	[4] 13.07	5.82	9.44	[4] 15.26	5.73	17.21	[4] 22.94	6.50	11.50	[6] 18.00	5.79	19.61	[4] 25.40
Charges	---	---	---	4.87	11.80	[5] 16.67	4.68	14.60	[5] 19.28	5.73	18.90	[4] 24.63	6.50	16.96	[6] 23.46	5.79	19.80	[4] 25.59
Enid, Okla.:																		
Costs	---	---	---	6.12	14.55	[4] 20.67	---	---	---	---	---	---	5.74	14.34	[4] 20.08	---	---	---
Charges	---	---	---	7.82	23.91	[7] 31.73	---	---	---	---	---	---	7.44	27.21	[7] 34.65	---	---	---
Evansville, Ind.:																		
Costs	---	---	---	5.10	5.25	[3] 10.35	6.09	10.37	[4] 16.46	5.73	16.95	[4] 22.68	4.72	4.24	[3] 8.96	5.79	19.59	[4] 25.38
Charges	---	---	---	4.87	12.10	[5] 16.97	4.68	15.90	[5] 20.58	5.73	27.90	[4] 33.63	4.72	12.36	[3] 17.08	5.79	28.80	[4] 34.59
Fort Dodge, Iowa:																		
Costs	6.11	8.72	[4] 14.83	---	---	---	---	---	---	5.47	20.27	[4] 25.74	6.50	15.67	[8] 22.17	5.53	21.95	[4] 27.48
Charges	5.16	15.00	[5] 20.16	---	---	---	---	---	---	5.47	44.40	[4] 49.87	6.50	22.18	[8] 28.68	11.34	34.00	[9] 45.34
Garden City, Kans.:																		
Costs	---	---	---	8.98	13.92	[10] 22.90	---	---	---	---	---	---	8.59	14.96	[10] 23.55	---	---	---
Charges	---	---	---	7.82	20.70	[7] 28.52	---	---	---	---	---	---	7.44	29.71	[7] 37.15	---	---	---
Indianapolis, Ind.:																		
Costs	---	---	---	6.12	7.18	[4] 13.30	5.83	7.67	[4] 13.50	5.47	14.74	[4] 20.21	---	---	---	5.53	17.14	[4] 22.67
Charges	---	---	---	4.87	12.20	[5] 17.07	4.68	14.10	[5] 18.78	5.47	25.80	[4] 31.27	---	---	---	5.53	26.70	[4] 32.23
Kansas City, Mo.:																		
Costs	---	---	---	6.04	4.70	[3] 10.74	---	---	---	5.09	20.41	[4] 25.50	5.66	5.74	[3] 11.40	---	---	---
Charges	---	---	---	6.04	10.41	[3] 16.45	---	---	---	5.09	37.20	[4] 42.29	5.66	13.71	[3] 19.37	---	---	---
Kearney, Nebr.:																		
Costs	---	---	---	6.12	13.29	[4] 19.41	---	---	---	5.47	24.26	[4] 29.73	8.59	14.46	[10] 23.05	5.53	26.16	[4] 31.69
Charges	---	---	---	4.87	26.10	[5] 30.97	---	---	---	5.47	54.00	[4] 59.47	7.44	28.31	[7] 35.75	11.04	45.10	[11] 56.14
Limon, Colo.:																		
Costs	---	---	---	6.12	17.64	[4] 23.76	---	---	---	---	---	---	8.59	16.95	[10] 25.54	---	---	---
Charges	---	---	---	7.82	31.91	[7] 39.73	---	---	---	---	---	---	7.44	35.21	[7] 42.65	---	---	---
Mankato, Minn.[12]																		
Costs	6.11	7.06	[4] 13.17	---	---	---	---	---	---	12.12	24.16	[13] 36.28	8.39	13.43	[14] 21.82	12.18	24.09	[13] 36.27
Charges	5.16	14.75	[5] 19.91	---	---	---	---	---	---	11.18	39.00	[15] 50.18	8.39	22.20	[14] 30.59	11.34	33.75	[9] 45.09
Memphis, Tenn.:																		
Costs	---	---	---	5.10	5.70	[3] 10.80	---	---	---	---	---	---	4.72	2.83	[3] 7.55	---	---	---
Charges	---	---	---	5.10	10.68	[3] 15.70	---	---	---	---	---	---	4.72	6.63	[3] 11.35	---	---	---
Minneapolis, Minn.:																		
Costs	6.36	6.05	[4] 12.41	---	---	---	---	---	---	5.73	20.64	[4] 26.37	6.60	6.83	[3] 13.43	5.79	21.10	[4] 26.89
Charges	6.36	6.00	[4] 12.36	---	---	---	---	---	---	5.73	33.90	[4] 39.63	6.60	15.60	[3] 22.20	12.54	25.00	[16] 37.54
Minot, N. Dak.[12]																		
Costs	6.11	10.60	[4] 16.71	---	---	---	---	---	---	12.12	27.70	[13] 39.82	9.33	18.01	[17] 27.34	12.18	27.63	[13] 39.81
Charges	5.16	19.40	[5] 24.56	---	---	---	---	---	---	11.18	43.65	[15] 54.83	8.39	36.20	[14] 44.59	11.34	38.40	[9] 49.74
Omaha, Nebr.:																		
Costs	---	---	---	5.10	5.70	[3] 10.80	---	---	---	5.73	21.65	[4] 27.38	4.72	6.74	[3] 11.46	---	---	---
Charges	---	---	---	5.10	12.30	[3] 17.40	---	---	---	5.73	37.20	[4] 42.93	4.72	15.60	[3] 20.32	---	---	---

See footnotes at end of table.

TABLE 75.--Wheat: Selected routings over which wheat can be moved from origin to port of export most economically (in cents per bushel)[1]--Continued

Origin of wheat, costs, charges	Duluth, Minn.			Chicago, Ill.			Toledo, Ohio			Baltimore, Md.			New Orleans, La.			New York, N. Y.		
	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total
Shelby, Mont.:[18]	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Costs	6.11	17.88	[4] 23.99	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Charges	5.16	40.20	[5] 45.36	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
St. Louis, Mo.:																		
Costs	---	---	---	6.04	3.36	[3] 9.40	---	---	---	5.09	18.62	[4] 23.71	5.66	4.18	[3] 9.84	---	---	---
Charges	---	---	---	6.04	5.82	[3] 11.86	---	---	---	5.09	23.10	[4] 28.19	5.66	8.67	[3] 14.33	---	---	---
Wichita, Kans.:																		
Costs	---	---	---	6.12	13.10	[4] 19.22	---	---	---	---	---	---	5.74	15.44	[4] 21.18	---	---	---
Charges	---	---	---	7.82	24.51	[7] 32.33	---	---	---	---	---	---	7.44	27.81	[7] 35.25	---	---	---

[1] Costs and charges are computed f.o.b. vessel at port of export. Out-of-pocket rail costs were used in computing the lowest cost routings, table 35, round-trip laker costs, table 52, and barge costs, table 41, except as noted below. Published rail and barge rates, tables 35 and 41, were incorporated in the analysis. Laker rates found in table 43 were used. Since no costs analysis were made covering grain handling, handling expenses, table 27, were incorporated in both the cost and the charge analysis. In the absence of data on trucking costs, trucking charges, table 30, were used in both the cost and charge analysis. Costs data covering barge operations on the New York State Barge Canal were not available and barge rates, table 43, were used in determining both costs and charges where this routing was pertinent to the analysis.

[2] The handling expenses include those at origin, at intermediate transfer points as applicable, and at port of export, table 27. Since the lowest cost and lowest charge routings often are not the same, handling charges vary between the same origin and port of export.

[3] Via barge.

[4] Via rail.

[5] Via truck.

[6] Via truck to Peoria (Ill.) and barge beyond.

[7] Via truck to Kansas City and barge beyond.

[8] Via truck to Burlington (Ia.) and barge beyond.

[9] Via truck to Duluth, laker to Oswego (N.Y.) and barge beyond.

[10] Via rail to Kansas City and barge beyond.

[11] Via truck to Chicago, laker to Oswego (N.Y.) and barge beyond.

[12] Although the all-rail analysis have not been made to New York City, New Orleans, and Baltimore, the origin falls within the general area from which the lowest combinations make through the Duluth Gateway for laker movement beyond.

[13] Via rail to Duluth, laker to Buffalo (N.Y.), and rail beyond.

[14] Via truck to Minneapolis and barge beyond.

[15] Via truck to Duluth, laker to Buffalo (N.Y.), and rail beyond.

[16] Via rail to Duluth, laker to Oswego (N.Y.), and barge beyond.

[17] Via rail to Minneapolis and barge beyond.

[18] From Shelby, Mont., to Portland, Oreg., the costs, in cents per bushel were: For handling, 6.99; for transportation, 14.92. The charges for handling were 6.47; for transportation, 37.20.

TABLE 76. --Corn: Selected routings over which corn can be moved from origin to port of export most economically (in cents per bushel)[1]

Origin of corn, costs, charges	Port of export																	
	Duluth, Minn.			Chicago, Ill.			Toledo, Ohio			Baltimore, Md.			New Orleans, La.			New York, N. Y.		
	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Cincinnati, Ohio:																		
Costs	---	---	---	5.10	7.03	[3] 12.13	6.09	7.03	[4] 13.12	5.73	12.55	[4] 18.28	4.72	5.94	[3] 10.66	5.79	15.05	[4] 20.84
Charges	---	---	---	5.10	17.39	[3] 22.49	4.68	14.03	[5] 18.71	5.73	24.08	[4] 29.81	4.72	14.70	[3] 19.42	5.79	24.92	[4] 30.71
Columbus, Ohio:																		
Costs	---	---	---	---	---	---	5.83	5.94	[4] 11.77	5.47	11.33	[4] 16.80	---	---	---	5.53	13.48	[4] 19.01
Charges	---	---	---	---	---	---	4.68	10.17	[5] 14.85	5.47	24.08	[4] 29.55	---	---	---	5.53	24.92	[4] 30.45
Decatur, Ill.:																		
Costs	---	---	---	6.12	6.57	[4] 12.69	5.83	8.92	[4] 14.75	5.73	16.25	[4] 21.98	6.50	12.31	[6] 18.81	5.79	18.51	[4] 24.30
Charges	---	---	---	4.87	12.64	[5] 17.51	4.68	15.64	[5] 20.32	5.73	17.64	[4] 23.37	6.50	16.71	[6] 23.21	5.79	18.48	[4] 24.27
Enid, Okla.:																		
Costs	---	---	---	6.12	14.59	[4] 20.71	---	---	---	---	---	---	5.74	13.69	[4] 19.43	---	---	---
Charges	---	---	---	7.82	24.18	[7] 32.00	---	---	---	---	---	---	7.44	27.26	[7] 34.70	---	---	---
Evansville, Ind.:																		
Costs	---	---	---	5.10	5.62	[3] 10.72	6.09	9.80	[4] 15.89	5.73	16.00	[4] 21.73	4.72	4.54	[3] 9.26	5.79	18.50	[4] 24.29
Charges	---	---	---	4.87	12.96	[5] 17.83	4.68	17.03	[5] 21.71	5.73	26.04	[4] 31.77	4.72	11.54	[3] 16.26	5.79	26.88	[4] 32.67
Fort Dodge, Iowa:																		
Costs	6.11	8.34	[4] 14.45	---	---	---	---	---	---	5.47	20.30	[4] 25.77	6.50	16.78	[8] 23.28	5.53	21.97	[4] 27.50
Charges	5.16	16.06	[5] 21.22	---	---	---	---	---	---	5.47	41.44	[4] 46.91	6.50	22.16	[8] 28.66	11.34	35.06	[9] 46.40
Garden City, Kans.:																		
Costs	---	---	---	8.98	13.85	[10] 22.83	---	---	---	---	---	---	5.74	17.18	[4] 22.92	---	---	---
Charges	---	---	---	7.82	22.17	[7] 29.99	---	---	---	---	---	---	7.44	29.94	[7] 37.38	---	---	---
Indianapolis, Ind.:																		
Costs	---	---	---	6.12	6.79	[4] 12.91	5.83	7.25	[4] 13.08	5.47	13.92	[4] 19.39	---	---	---	5.53	16.18	[4] 21.71
Charges	---	---	---	4.87	13.07	[5] 17.94	4.68	15.10	[5] 19.78	5.47	24.08	[4] 29.55	---	---	---	5.53	24.92	[4] 30.45
Kansas City, Mo.:																		
Costs	---	---	---	6.04	5.03	[3] 11.07	---	---	---	5.09	20.43	[4] 25.52	5.66	6.15	[3] 11.81	---	---	---
Charges	---	---	---	6.04	9.72	[3] 15.76	---	---	---	5.09	34.72	[4] 39.81	5.66	12.80	[3] 18.46	---	---	---
Kearney, Nebr.:																		
Costs	---	---	---	6.12	13.34	[4] 19.46	---	---	---	5.47	24.27	[4] 29.74	8.59	14.46	[10] 23.05	5.53	26.16	[4] 31.69
Charges	---	---	---	4.87	27.95	[5] 32.82	---	---	---	5.47	50.40	[4] 55.87	7.44	28.44	[7] 35.88	5.53	51.24	[4] 56.77
Limon, Colo.:																		
Costs	---	---	---	6.12	17.67	[4] 23.79	---	---	---	---	---	---	8.59	16.86	[10] 25.45	---	---	---
Charges	---	---	---	7.82	32.75	[7] 40.57	---	---	---	---	---	---	7.44	35.83	[7] 43.27	---	---	---
Mankato, Minn.:[11]																		
Costs	6.11	6.76	[4] 12.87	---	---	---	---	---	---	12.12	23.71	[12] 35.83	8.39	14.38	[13] 22.77	12.18	23.65	[12] 35.83
Charges	5.16	15.80	[5] 20.96	---	---	---	---	---	---	11.18	39.25	[14] 50.43	8.39	21.63	[13] 30.02	11.34	34.80	[9] 46.14
Memphis, Tenn.:																		
Costs	---	---	---	5.10	6.10	[3] 11.20	---	---	---	---	---	---	4.72	3.03	[3] 7.75	---	---	---
Charges	---	---	---	5.10	9.97	[3] 15.07	---	---	---	---	---	---	4.72	6.19	[3] 10.91	---	---	---
Minneapolis, Minn.:																		
Costs	6.36	5.80	[4] 12.16	---	---	---	---	---	---	5.73	20.66	[4] 26.39	6.60	7.31	[3] 13.91	5.79	21.12	[4] 26.91
Charges	6.36	5.60	[4] 11.96	---	---	---	---	---	---	5.73	31.64	[4] 37.37	6.60	14.56	[3] 21.16	12.54	24.60	[15] 37.14
Minot, N. Dak.:[11]																		
Costs	6.11	10.12	[4] 16.23	---	---	---	---	---	---	12.12	27.07	[12] 39.19	9.33	17.99	[16] 27.32	12.18	27.01	[12] 39.19
Charges	5.16	20.78	[5] 25.94	---	---	---	---	---	---	11.18	44.23	[13] 55.41	8.39	36.62	[13] 45.01	11.34	39.78	[9] 51.12

See footnotes at end of table.

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TABLE 76. --Corn: Selected routings over which corn can be moved from origin to port of export most economically (in cents per bushel)[1]--Continued

Origin of corn, costs, charges	Port of export																	
	Duluth, Minn.			Chicago, Ill.			Toledo, Ohio			Baltimore, Md.			New Orleans, La.			New York, N. Y.		
	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total
Omaha, Nebr.:	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Costs	---	---	---	5.10	6.10	[3] 11.20	---	---	---	5.73	21.67	[4] 27.40	4.72	7.22	[3] 11.94	---	---	---
Charges	---	---	---	5.10	11.48	[3] 16.58	---	---	---	5.73	34.72	[4] 40.45	4.72	14.56	[3] 19.28	---	---	---
St. Louis, Mo.:																		
Costs	---	---	---	6.04	3.60	[3] 9.64	---	---	---	5.09	17.58	[4] 22.67	5.66	4.48	[3] 10.14	---	---	---
Charges	---	---	---	6.04	5.43	[3] 11.47	---	---	---	5.09	21.56	[4] 26.65	5.66	8.09	[3] 13.75	---	---	---
Wichita, Kans.:																		
Costs	---	---	---	6.12	13.15	[4] 19.27	---	---	---	---	---	---	5.74	14.74	[4] 20.48	---	---	---
Charges	---	---	---	7.82	24.82	[7] 32.64	---	---	---	---	---	---	7.44	27.90	[7] 35.34	---	---	---

[1] Costs and charges are computed f.o.b. vessel at port of export. Out-of-pocket rail costs were used in computing cost routings table 35, round-trip laker costs, table 53, and barge costs, tables 41, except as noted below. Published rail and barge rates tables 35 and 41, were incorporated in the analysis. Laker rates found in table 43 were used. Since no costs analysis were made covering grain handling, handling expenses, table 27, were incorporated in both the cost and charge analysis. In the absence of data on trucking costs, trucking charges, table 31, were used in both the cost and charge analysis. Costs data covering barge operations on the New York State Barge Canal were not available, and barge rates, table 43, were used in determining both costs and charges where this routing was pertinent to the analysis.

[2] The handling expenses include those at origin, at intermediate transfer points, as applicable, and at port of export, table 27. Since the lowest cost and the lowest charge routings often are not the same, handling charges vary between the same origin and port of export.

[3] Via barge.

[4] Via rail.

[5] Via truck.

[6] Via truck to Peoria (Ill.) and barge beyond.

[7] Via truck to Kansas City (Mo.) barge beyond.

[8] Via truck to Burlington (Ia.) and barge beyond.

[9] Via truck to Duluth, laker to Owsego (N.Y.) and barge beyond.

[10] Via rail to Kansas City and barge beyond.

[11] Although the all-rail analysis have not been made to New Orleans, New York City, and Baltimore, the origin falls within the general area from which the lowest combinations make through the Duluth gateway for laker movement beyond.

[12] Via rail to Duluth, laker to Buffalo, and rail beyond.

[13] Via truck to Minneapolis and barge beyond.

[14] Via truck to Duluth, laker to Buffalo, and rail beyond.

[15] Via rail to Duluth, laker to Oswego (N.Y.) and barge beyond.

[16] Via rail to Minneapolis and barga beyond.

TABLE 77.--Barley: Selected routings over which barley can be moved most economically from origin to port of export (in cents per bushel)[1]

Origins of barley, cost, charges	Port of export																	
	Duluth, Minn.			Chicago, Ill.			Toledo, Ohio			Baltimore, Md.			New Orleans, La.			New York, N. Y.		
	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Cincinnati, Ohio:																		
Costs	---	---	---	5.10	8.19	[3] 13.29	6.09	6.36	[4] 12.45	5.73	11.31	[4] 17.04	4.72	6.93	[3] 11.65	5.79	13.55	[4] 19.34
Charges	---	---	---	5.10	14.90	[4] 20.00	6.09	12.45	[4] 19.04	5.73	20.64	[4] 26.37	4.72	12.60	[3] 17.32	5.79	21.36	[4] 27.15
Columbus, Ohio:																		
Costs	---	---	---	---	---	---	5.83	5.38	[4] 11.21	5.47	10.20	[4] 15.67	---	---	---	5.53	12.14	[4] 17.67
Charges	---	---	---	---	---	---	4.68	11.87	[5] 16.55	5.47	20.64	[4] 26.11	---	---	---	5.53	21.36	[4] 26.89
Decatur, Ill.:																		
Costs	---	---	---	6.12	5.95	[4] 12.07	5.83	8.05	[4] 13.88	5.73	14.63	[4] 20.36	5.74	12.73	[4] 18.47	5.79	16.66	[4] 22.45
Charges	---	---	---	6.12	11.52	[4] 17.64	4.68	18.24	[5] 22.92	5.73	15.12	[4] 20.85	5.74	16.56	[4] 22.30	5.79	15.84	[4] 21.63
Enid, Okla.:																		
Costs	---	---	---	6.12	12.35	[4] 18.47	---	---	---	---	---	---	5.74	12.17	[4] 17.91	---	---	---
Charges	---	---	---	7.82	25.19	[6] 33.01	---	---	---	---	---	---	7.44	27.83	[6] 35.27	---	---	---
Evansville, Ind.:																		
Costs	---	---	---	5.10	6.56	[3] 11.66	6.09	8.84	[4] 14.93	5.73	14.41	[4] 20.14	4.72	5.30	[4] 10.02	5.79	16.65	[4] 22.44
Charges	---	---	---	5.10	13.25	[3] 18.35	4.68	19.86	[5] 24.54	5.73	22.32	[4] 28.05	4.72	9.89	[4] 14.61	5.79	23.04	[4] 28.83
Fort Dodge, Iowa:																		
Costs	6.11	7.44	[4] 13.55	---	---	---	---	---	---	5.47	17.18	[4] 22.65	5.74	16.03	[4] 21.77	5.53	18.60	[4] 24.13
Charges	5.16	18.73	[5] 23.89	---	---	---	---	---	---	5.47	35.52	[4] 40.99	6.50	22.50	[7] 29.00	5.53	36.24	[4] 41.77
Garden City, Kans.:																		
Costs	---	---	---	8.97	13.73	[8] 22.70	---	---	---	---	---	---	5.74	15.25	[4] 20.99	---	---	---
Charges	---	---	---	7.82	25.85	[6] 33.67	---	---	---	---	---	---	7.44	30.95	[6] 38.39	---	---	---
Indianapolis, Ind.:																		
Costs	---	---	---	6.12	6.14	[4] 12.26	5.83	6.55	[4] 12.38	5.47	12.54	[4] 18.01	---	---	---	5.53	14.57	[4] 20.10
Charges	---	---	---	4.87	15.24	[5] 20.11	5.83	14.40	[4] 20.23	5.47	20.64	[4] 26.11	---	---	---	5.53	21.36	[4] 26.89
Kansas City, Mo.:																		
Costs	---	---	---	6.04	5.87	[3] 11.91	---	---	---	5.09	17.29	[4] 22.38	5.66	7.17	[3] 12.83	---	---	---
Charges	---	---	---	6.04	8.33	[3] 14.37	---	---	---	5.09	29.76	[4] 34.85	5.66	10.97	[3] 16.63	---	---	---
Kearney, Nebr.:																		
Costs	---	---	---	6.12	11.28	[4] 17.40	---	---	---	5.47	20.55	[4] 26.02	5.74	15.96	[4] 21.70	5.53	22.15	[4] 27.68
Charges	---	---	---	8.97	21.77	[8] 30.74	---	---	---	5.47	43.20	[4] 48.67	8.59	24.41	[8] 33.00	5.53	43.92	[4] 49.45
Limon, Colo.:																		
Costs	---	---	---	6.12	14.96	[4] 12.08	---	---	---	---	---	---	5.74	17.94	[4] 23.68	---	---	---
Charges	---	---	---	8.97	32.33	[8] 41.30	---	---	---	---	---	---	8.59	34.97	[8] 43.56	---	---	---
Mankato, Minn.:[9]																		
Costs	6.11	6.04	[4] 12.15	---	---	---	---	---	---	12.12	23.11	[10] 35.23	9.33	13.60	[11] 22.93	12.18	23.05	[10] 35.23
Charges	6.11	14.64	[4] 20.75	---	---	---	---	---	---	12.12	38.17	[10] 50.29	8.39	20.72	[12] 29.11	12.28	33.64	[13] 45.92
Memphis, Tenn.:																		
Costs	---	---	---	5.10	7.12	[3] 12.22	---	---	---	---	---	---	4.72	3.53	[3] 8.25	---	---	---
Charges	---	---	---	5.10	8.54	[3] 13.64	---	---	---	---	---	---	4.72	5.30	[3] 10.02	---	---	---
Minneapolis, Minn.:																		
Costs	6.36	5.19	[4] 11.55	---	---	---	---	---	---	5.73	17.49	[4] 23.22	6.60	8.53	[3] 15.13	5.79	17.88	[4] 23.67
Charges	6.36	4.80	[4] 11.16	---	---	---	---	---	---	5.73	27.12	[4] 32.85	6.60	12.48	[3] 19.08	5.79	27.84	[4] 33.63
Minot, N. Dak.:[9]																		
Costs	6.11	9.01	[4] 15.12	---	---	---	---	---	---	12.12	26.08	[10] 38.20	9.33	18.04	[11] 27.37	12.18	26.02	[10] 38.20
Charges	6.11	23.28	[4] 29.39	---	---	---	---	---	---	12.12	46.81	[10] 58.93	9.33	35.76	[11] 45.09	12.28	42.28	[13] 54.56
Omaha, Nebr.:																		
Costs	---	---	---	5.10	7.12	[3] 12.22	---	---	---	5.73	18.35	[4] 24.08	4.72	8.42	[3] 13.14	---	---	---
Charges	---	---	---	5.10	9.84	[3] 14.94	---	---	---	5.73	29.76	[4] 35.49	4.72	12.48	[3] 17.20	---	---	---

TABLE 77.--Barley: Selected routings over which barley can be moved most economically from origin to port of export (in cents per bushel)[1] --Continued

Origins of barley, costs, charges	Port of export																	
	Duluth, Minn.			Chicago, Ill.			Toledo, Ohio			Baltimore, Md.			New Orleans, La.			New York, N. Y.		
	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Shelby, Mont.:[14]																		
Costs	6.11	15.14	[4] 21.25	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Charges	6.11	38.88	[4] 44.99	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
St. Louis, Mo.:																		
Costs	---	---	---	6.04	4.20	[3] 10.24	---	---	---	5.09	15.83	[4] 20.92	5.66	5.22	[3] 10.88	---	---	---
Charges	---	---	---	6.04	4.66	[3] 10.70	---	---	---	5.09	18.48	[4] 23.57	5.66	6.94	[3] 12.60	---	---	---
Wichita, Kans.:																		
Costs	---	---	---	6.12	11.13	[4] 17.25	---	---	---	---	---	---	5.74	13.09	[4] 18.83	---	---	---
Charges	---	---	---	8.97	23.45	[8] 32.42	---	---	---	---	---	---	8.59	26.09	[8] 34.68	---	---	---

[1] Costs and charges are computed f.o.b. vessel at port of export. Out-of-pocket rail costs were used in computing lowest cost routings, table 35, round-trip laker costs, table 54, and barge costs, table 41, except as noted below. Published rail and barge rates, tables 35 and 41, were incorporated in the analysis. Laker rates found in table 43 were used. Since no costs analysis were made covering grain handling, handling expenses, table 27, were incorporated in both the cost and the charge analysis. In the absence of data on trucking costs, trucking charges, table 32, were used in both the costs and charges analysis. Costs data covering barge operations on the New York State Barge Canal were not available and barge rates, table 43, were used in determing both costs and charges where this routing was pertinant to the analysis.

[2] The handling expenses include those at origin, at intermediate transfer points as applicable, and at port of export, table 27. Since the lowest cost and the lowest charge routings often are not the same, handling charges vary between the same origin and port of export.

[3] Via barge.

[4] Via rail.

[5] Via truck.

[6] Via truck to Kansas City and barge beyond.

[7] Via truck to Burlington (Iowa) and barge beyond.

[8] Via rail to Kansas City and barge beyond.

[9] Although the all-rail analysis have not been made to New Orleans, New York City, and Baltimore, the origin falls within the general area from which the lowest combinations for heavy grain make through the Duluth Gateway for laker movement beyond. The high cubic required for barley results in generally higher shipping costs. Therefore, it is possible that actual costs and charges may be slightly lower over all-rail routings, although it is not believed this would affect significantly the overall export analysis on to foreign ports, see table 81.

[10] Via rail to Duluth, laker to Buffalo (N.Y.) and rail beyond.

[11] Via rail to Minneapolis and barge beyond.

[12] Via truck to Minneapolis and barge beyond.

[13] Via rail to Duluth, laker to Oswego (N.Y.) and barge beyond.

[14] From Shelby, Mont., to Portland, Oreg., the costs in cents per bushel were: For handling, 6.99, for transportation, 12.66. Charges for handling were 6.99; for transportation, 32.16.

TABLE 78. --Soybeans: Selected routings over which soybeans can be moved most economically from origin to port of export (in cents per bushel)[1]

Origins, for soybeans, costs, charges	Port of export																	
	Duluth, Minn.			Chicago, Ill.			Toledo, Ohio			Baltimore, Md.			New Orleans, La.			New York, N. Y.		
	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Cincinnati, Ohio:																		
Costs	---	---	---	5.10	6.56	[3] 11.66	6.09	7.49	[4] 13.58	5.73	13.41	[4] 19.14	4.72	5.55	[3] 10.27	5.79	16.08	[4] 21.87
Charges	---	---	---	5.10	18.63	[3] 23.73	4.68	13.10	[5] 17.78	5.73	30.00	[4] 35.73	6.00	14.40	[4] 20.40	5.79	30.90	[4] 36.69
Columbus, Ohio:																		
Costs	---	---	---	---	---	---	5.83	6.32	[4] 12.15	5.47	12.09	[4] 17.56	---	---	---	5.53	14.40	[4] 19.93
Charges	---	---	---	---	---	---	4.68	9.50	[5] 14.18	5.47	27.00	[4] 32.47	---	---	---	5.53	27.90	[4] 33.43
Decatur, Ill.:																		
Costs	---	---	---	6.12	7.01	[4] 13.13	5.83	9.52	[4] 15.35	5.73	17.36	[4] 23.09	6.50	11.50	[6] 18.00	5.79	19.79	[4] 25.58
Charges	---	---	---	4.87	11.80	[5] 16.67	4.68	14.60	[5] 19.28	5.73	25.80	[4] 31.53	6.50	16.96	[6] 23.46	5.79	26.70	[4] 32.49
Enid, Okla.:																		
Costs	---	---	---	6.12	15.40	[4] 21.52	---	---	----	---	---	---	5.74	14.80	[4] 20.54	---	---	---
Charges	---	---	---	7.82	23.91	[7] 31.73	---	---	---	---	---	---	7.44	27.21	[7] 34.65	---	---	---
Evansville, Ind.:																		
Costs	---	---	---	5.10	5.25	[3] 10.35	6.09	10.46	[4] 16.55	5.73	17.11	[4] 22.84	4.72	4.24	[3] 8.96	5.79	19.78	[4] 25.57
Charges	---	---	---	4.87	12.10	[5] 16.97	4.68	15.90	[5] 20.58	5.79	41.10	[4] 26.89	4.72	12.36	[3] 17.08	10.85	30.90	[8] 41.75
Fort Dodge, Iowa:																		
Costs	6.11	9.01	[4] 15.12	---	---	---	---	---	---	5.47	21.44	[4] 26.91	6.50	15.67	[9] 22.17	5.53	23.21	[4] 28.74
Charges	5.16	15.00	[5] 20.16	---	---	---	---	---	---	11.18	39.25	[10] 50.43	6.50	22.18	[9] 28.68	11.34	34.00	[11] 45.34
Garden City, Kans.:																		
Costs	---	---	---	8.98	14.23	[12] 23.21	---	---	---	---	---	---	8.59	15.27	[12] 23.86	---	---	---
Charges	---	---	---	7.82	20.70	[7] 28.52	---	---	---	---	---	---	7.44	29.71	[7] 37.15	---	---	---
Indianapolis, Ind.:																		
Costs	---	---	---	6.12	7.24	[4] 13.36	5.83	7.72	[4] 13.55	5.47	14.87	[4] 20.34	---	---	---	5.53	17.30	[4] 22.83
Charges	---	---	---	4.87	12.20	[5] 17.07	4.68	14.10	[5] 18.78	5.47	27.00	[4] 32.47	---	---	---	5.53	32.70	[4] 38.23
Kansas City, Mo.:																		
Costs	---	---	---	6.04	4.70	[3] 10.74	---	---	---	5.09	21.58	[4] 26.67	5.66	5.74	[3] 11.40	---	---	---
Charges	---	---	---	6.04	10.41	[3] 16.45	---	---	---	12.06	34.66	[13] 46.72	5.66	13.71	[3] 19.37	---	---	---
Kearney, Nebr.:																		
Costs	---	---	---	6.12	14.07	[4] 20.19	---	---	---	5.47	25.64	[4] 31.11	8.59	14.75	[12] 23.34	5.53	27.65	[4] 33.18
Charges	---	---	---	4.87	26.10	[5] 30.97	---	---	---	10.88	50.35	[14] 61.23	7.44	28.31	[7] 35.75	11.04	45.10	[15] 56.14
Mankato, Minn.:[16]																		
Costs	6.11	7.30	[4] 13.41	---	---	---	---	---	---	12.12	24.49	[17] 36.61	8.39	13.43	[18] 21.82	12.18	24.42	[17] 36.60
Charges	5.16	14.75	[5] 19.91	---	---	---	---	---	---	11.18	39.00	[9] 50.18	8.39	22.20	[18] 30.59	11.34	33.75	[11] 45.09
Memphis, Tenn.:																		
Costs	---	---	---	5.10	5.70	[3] 10.80	---	---	---	---	---	---	4.72	2.83	[3] 7.55	---	---	---
Charges	---	---	---	5.10	10.68	[3] 15.78	---	---	---	---	---	---	4.72	6.63	[3] 11.35	---	---	---
Minneapolis, Minn.:																		
Costs	6.36	6.26	[4] 12.62	---	---	---	---	---	---	5.73	21.82	[4] 27.55	6.60	6.83	[3] 13.43	5.79	22.31	[4] 28.10
Charges	6.36	6.00	[4] 12.36	---	---	---	---	---	---	12.38	30.25	[17] 42.63	6.60	15.60	[3] 22.20	12.54	25.00	[19] 37.54
Minot, N. Dak.:[16]																		
Costs	6.11	10.94	[4] 17.05	---	---	---	---	---	---	12.12	28.13	[17] 40.25	9.33	18.38	[20] 27.71	12.18	28.06	[17] 40.24
Charges	5.16	19.40	[5] 24.56	---	---	---	---	---	---	11.18	43.65	[9] 54.83	8.39	36.20	[18] 44.59	11.34	38.40	[11] 49.74

See footnotes at end of table.

TABLE 78. --Soybeans: Selected routings over which soybeans can be moved most economically from origin to port of export (in cents per bushel)[1]--Continued

Origins, for soybeans, costs, charges	Port of export																	
	Duluth, Minn.			Chicago, Ill.			Toledo, Ohio			Baltimore, Md.			New Orleans, La.			New York, N. Y.		
	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Total	Handling expense[2]	Transportation	Totel	Handling expense[2]	Transportation	Total
Omaha, Nebr.:	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Costs	---	---	----	5.10	5.70	[3] 10.80	---	---	---	5.73	22.89	[4] 28.62	4.72	6.74	[3] 11.46	---	---	---
Charges	---	---	---	5.10	12.30	[3] 17.40	---	---	---	11.12	36.55	[13] 47.67	4.72	15.60	[3] 20.32	---	---	---
St Louis, Mo.:																		
Costs	---	---	---	6.04	3.36	[3] 9.40	---	---	---	5.09	18.80	[4] 23.89	5.66	4.18	[3] 9.84	---	---	---
Charges	---	---	---	6.04	5.82	[3] 11.86	---	---	---	5.09	30.00	[4] 35.09	5.66	8.67	[3] 14.33	---	---	---
Wichita, Kans.:																		
Costs	---	---	---	6.12	13.87	[4] 19.99	---	---	---	---	---	---	5.74	15.94	[4] 21.68	---	---	---
Charges	---	---	---	7.82	24.51	[7] 32.33	---	---	---	---	---	---	7.44	27.81	[7] 35.25	---	---	---

[1] Costs and charges are computed f.o.b. vessel at port of export. Out-of-pocket rail costs were used in computing lowest cost routing, table 35, round-trip laker costs, table 52, and barge costs table 41, except as noted below. Published rail and barge rates, table 35 and 41, were incorporated in the analysis. Laker rates found in table 43 were used. Since no costs anelysis were made covering grein handling, handling expenses, table 27, were incorporated in both the costs and the charges analysis. In the absence of data on trucking costs, trucking charges, table 30, were used in both the cost and charge analysis. Costs data covering barge operations on the New York State Barge Canal were not available and barge retes, table 43, were used in determining both costs and charges where this routing was pertinent to the analysis.

[2] The handling expenses include those at origin, at intermediate transfer points as epplicable, and at port of export, table 27. Since the lowest cost and the lowest charge routings often are not the same, handling charges vary between the same origin and port of export.

[3] Via barge.

[4] Via rail.

[5] Via truck.

[6] Via truck to Peoria (Ill.) and barge beyond.

[7] Via truck to Kansas City and barge beyond.

[8] Via truck to Toledo, laker to Oswego (N.Y.) and barge beyond.

[9] Via truck to Burlington (Ia.) and barge beyond.

[10] Via truck to Duluth, laker to Buffalo (N.Y.) and rail beyond.

[11] Via truck to Duluth, laker to Oswego (N.Y.) and barge beyond.

[12] Via rail to Kansas City and barge beyond.

[13] Via barge to Chicago, laker to Buffalo (N.Y.) and rail beyond.

[14] Via truck to Chicago, laker to Buffalo (N.Y.) and rail beyond.

[15] Via truck to Chicago, laker to Oswego (N.Y.) and barge beyond.

[16] Although the all-rail analysis have not been made to New Orleans, New York City, and Baltimore, the origin falls within the general area from which the lowest combinations make through the Duluth Ceteway for laker movement beyond.

[17] Via rail to Duluth, laker to Buffalo (N.Y.) and rail beyond.

[18] Via truck to Minneapolis and barge beyond.

[19] Via rail to Duluth, laker to Oswego (N.Y.) and barge beyond.

[20] Via rail to Minneapolis and barge beyond.

TABLE 79.--Wheat: Estimated total costs, for the handling and transportation of wheat between selected U.S. origins and selected foreign destinations, with overseas movement in a Liberty-type vessel or in a lake-ocean bulk carrier, and total handling and transportation charges, via existing routings, (In cents per bushel), 1957[1]

Origin of wheat	Port of export[2]	Destination														
		Rotterdam, Netherlands					Casablanca, Morocco					Santos, Brazil				
		Charges via existing routes	Costs				Charges via existing routes	Costs				Charges via existing routes	Costs			
			Liberty vessel[3]		Lake-ocean[3] bulk carrier			Liberty vessel[3]		Lake-ocean[3] bulk carrier			Liberty vessel[3]		Lake-ocean[3] bulk carrier	
			1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]		1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]		1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]
		Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Duluth, Minn.....	Duluth, Minn.....	[6] 35.30	21.43	27.63	18.07	23.74	[6] 36.10	21.78	28.34	18.36	24.33	[6] 41.90	25.73	36.42	21.59	30.87
	New York, N. Y.....	38.88	35.03	38.25	30.11	34.87	41.98	34.64	37.47	29.80	34.23	43.38	37.84	44.00	32.42	39.49
	Baltimore, Md.....	40.37	33.24	38.22	29.47	34.68	43.47	33.15	38.04	29.39	34.52	44.87	35.64	43.09	31.43	38.61
Chicago, Ill.....	Chicago, Ill.....	[6] 35.31	21.23	27.25	17.79	23.32	[6] 36.11	21.58	27.97	18.07	23.89	[6] 41.91	25.33	36.05	21.30	30.43
	New York, N. Y.....	38.88	34.41	37.63	29.49	34.25	41.98	34.02	36.85	29.18	33.61	43.38	37.22	43.38	31.80	38.87
	Baltimore, Md.....	40.37	32.62	37.60	28.85	34.06	43.47	32.53	37.42	28.77	33.90	44.87	35.02	42.47	30.81	37.99
Toledo, Ohio.....	Toledo, Ohio.....	[6] 29.03	19.59	24.53	16.13	20.79	[6] 29.83	19.94	25.24	16.41	21.36	[6] 35.63	23.99	33.33	19.64	27.90
	New York, N. Y.....	34.88	31.14	34.36	26.22	30.98	37.98	30.75	33.58	25.91	30.34	39.38	33.95	40.11	28.53	35.60
	Baltimore, Md.....	36.37	29.35	34.33	25.58	30.79	39.47	29.26	34.15	25.50	30.63	40.87	31.75	39.20	27.54	34.72
Cincinneti, Ohio.....	Chicago, Ill.....	55.97	29.82	35.84	26.38	31.91	56.77	30.17	36.56	26.66	32.48	62.57	34.12	44.64	29.89	39.02
	Toledo, Ohio.....	44.02	30.34	35.28	26.88	31.54	44.82	30.69	35.99	13.53	32.11	50.62	34.74	44.08	30.39	38.65
	New Orleans, Le.....	36.39	26.95	33.18	21.68	28.55	42.59	26.77	32.74	21.52	28.24	39.39	27.95	35.13	22.48	30.17
	New York, N. Y.....	46.19	36.65	39.87	31.73	36.49	49.29	36.26	39.09	31.42	33.85	50.69	39.46	45.62	34.04	41.11
	Baltimore, Md.....	45.23	32.74	37.72	28.97	34.18	48.33	32.65	37.54	28.89	34.02	49.73	35.14	42.59	30.93	38.11
Columbus, Ohio.....	Toledo, Ohio.....	40.42	28.92	33.86	25.46	30.12	41.22	29.27	34.57	25.74	30.69	47.02	33.32	42.66	28.97	37.23
	New York, N. Y.....	45.93	35.32	38.54	30.42	35.16	49.03	34.93	37.76	30.09	34.52	50.43	38.13	44.29	32.71	39.78
	Baltimore, Md.....	44.97	31.18	36.16	27.41	32.62	48.07	31.09	35.98	27.33	32.46	49.47	33.58	41.03	29.37	36.55
Decatur, Ill.....	Chicago, Ill.....	48.91	31.23	37.25	27.79	33.32	49.71	31.58	37.97	28.07	33.89	55.51	35.53	46.05	31.30	40.43
	Toledo, Ohio.....	45.52	32.08	37.02	28.62	33.28	46.32	32.43	37.73	28.90	33.85	52.12	36.48	45.82	32.13	40.39
	New Orleans, Le.....	39.46	34.68	40.86	29.41	36.28	45.66	34.50	40.47	29.25	35.97	42.46	35.68	42.86	30.21	37.90
	New York, N. Y.....	39.29	40.92	44.14	36.00	40.76	42.39	40.53	43.36	35.69	40.12	43.79	43.73	49.89	38.31	45.38
	Baltimore, Md.....	38.33	36.66	41.64	32.89	38.10	41.43	36.57	41.46	32.81	37.94	42.83	39.06	46.51	34.85	42.03
Enid, Okla.....	Chicago, Ill.....	63.98	38.83	44.85	35.39	40.92	64.78	39.18	45.57	35.67	41.49	70.58	43.13	53.65	38.90	48.03
	New Orlsans, La.....	50.65	36.76	42.94	31.49	38.36	56.85	36.58	42.55	31.33	38.05	53.65	37.76	44.94	32.21	39.98
Evansville, Ind.....	Chicago, Ill.....	49.21	28.51	34.53	25.07	30.60	50.01	28.86	35.25	25.35	31.17	55.81	32.81	43.33	28.58	37.71
	Toledo, Ohio.....	46.82	33.29	38.21	29.81	34.47	47.62	33.62	38.92	30.09	35.04	53.42	37.67	47.01	33.32	41.58
	New Orleans, La.....	33.08	25.64	31.82	20.37	27.24	39.28	25.46	31.43	20.21	26.93	36.08	26.64	33.82	21.17	28.86
	New York, N. Y.....	48.29	40.90	44.12	35.98	40.74	51.39	40.51	43.34	35.67	40.10	52.79	43.71	49.87	38.29	45.36
	Baltimore, Md.....	47.33	36.40	41.38	32.63	37.84	50.43	36.31	41.20	32.55	37.68	51.83	38.80	46.25	34.59	41.77
Fort Dodge, Ia.....	Duluth, Minn.....	52.41	33.20	39.40	29.84	35.51	53.21	33.55	40.11	30.13	36.10	59.01	37.50	48.19	33.36	42.64
	New Orleans, La.....	44.68	38.85	45.03	33.58	40.45	50.88	38.67	44.64	33.42	40.14	47.68	39.85	47.03	34.38	42.07
	New York, N. Y.....	59.04	43.00	46.22	38.08	42.84	62.14	42.61	45.44	37.77	42.20	63.54	45.81	51.97	40.39	47.46
	Baltimore, Md.....	63.57	39.46	44.44	35.69	40.90	66.67	39.40	44.26	35.61	40.74	67.07	41.86	49.31	37.65	44.83
Garden City, Kan.....	Chicago, Ill.....	60.77	41.05	47.07	37.61	43.14	61.57	41.40	47.79	37.89	43.71	67.37	45.35	55.87	41.12	50.25
	New Orleans, La.....	53.15	40.23	46.41	34.96	41.83	59.35	40.05	46.02	34.80	41.52	56.15	41.23	48.41	35.76	43.45
Indianapolis, Ind.....	Chicago, Ill.....	49.31	31.46	37.48	28.02	33.55	50.11	31.81	38.20	28.30	34.12	55.91	35.76	46.28	31.53	40.66
	Toledo, Ohio.....	45.02	30.31	35.25	26.85	31.51	45.82	30.66	35.96	27.13	32.08	51.62	34.71	44.05	30.36	38.62
	New York, N. Y.....	45.93	38.19	41.41	33.27	38.03	49.03	37.80	40.63	32.96	37.39	50.43	41.00	47.16	35.58	42.65
	Baltimore, Md.....	44.97	33.93	38.91	30.16	35.37	48.07	33.84	38.73	30.08	35.21	49.47	36.33	43.78	32.12	39.30
Kansas City, Mo.....	Chicago, Ill.....	48.69	28.90	34.92	25.46	30.99	49.49	29.25	35.64	25.74	31.56	55.29	33.20	43.72	28.97	38.10
	New Orleans, La.....	35.37	28.08	34.26	22.81	29.68	41.57	27.90	33.87	22.65	29.37	38.37	29.08	36.26	23.61	31.30
	Baltimore, Md.....	55.99	39.22	44.20	35.45	40.66	59.09	39.13	44.02	35.37	40.50	60.49	41.62	49.07	37.41	44.59
Kearney, Nebr.....	Chicago, Ill.....	63.21	35.57	43.59	34.13	39.66	64.01	37.92	44.31	34.41	40.23	69.81	41.87	52.39	37.64	46.77
	New Orleans, La.....	51.75	39.73	45.91	34.46	41.33	57.77	39.55	45.52	34.30	41.02	54.75	40.73	47.91	35.26	42.95
	New York, N. Y.....	69.84	47.21	50.43	42.29	47.05	72.94	46.82	49.65	41.98	46.41	74.34	50.02	56.18	44.60	51.67
	Baltimore, Md.....	73.17	43.45	48.43	39.68	44.89	76.27	43.36	48.25	39.60	44.73	77.67	45.85	53.30	41.64	48.82

See footnotes at end of table.

TABLE 79. --Wheat: Estimated total costs, for the handling and transportation of wheat between selected U.S. origins and selected foreign destinations, with overseas movement in a Liberty-type vessel or in a lake-ocean bulk carrier, and total handling and transportation charges, via existing routings, (in cents per bushel), 1957[1] --Continued

Origin of wheat	Port of export[2]	Destination														
		Rotterdam, Netherlands					Casablanca, Morocco					Santos, Brazil				
		Charges via existing routes	Costs				Charges via existing routes	Costs				Charges via existing routes	Costs			
			Liberty vessel[3]		Lake-ocean[3] bulk carrier			Liberty vessel[3]		Lake-ocean[3] bulk carrier			Liberty vessel[3]		Lake-ocean[3] bulk carrier	
			1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]		1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]		1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]
		Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Limon, Colo.....	Chicago, Ill.....	71.98	41.92	47.94	38.48	44.01	72.78	42.27	48.66	38.76	44.58	78.58	46.22	56.74	41.99	51.12
	New Orleans, La.....	58.65	42.22	48.40	36.95	43.82	64.85	42.04	48.01	36.79	43.51	61.65	43.22	50.40	37.75	45.44
Mankato, Minn.....	Duluth, Minn.....	52.16	31.54	37.74	28.18	33.85	52.96	31.89	38.45	28.47	34.44	58.76	35.84	46.53	31.70	40.98
	New Orleans, La.....	46.59	38.50	44.68	33.23	40.10	52.79	38.32	44.29	33.07	39.79	49.59	39.50	46.68	34.03	41.72
	New York, N. Y.....	58.79	51.79	55.01	46.87	51.63	61.89	51.40	54.23	46.56	50.99	63.29	54.60	60.76	49.18	56.25
	Baltimore, Md.....	63.88	50.00	54.98	46.23	51.44	66.98	49.91	54.80	46.15	51.28	68.38	52.40	59.85	48.19	55.37
Memphis, Tenn.....	Chicago, Ill.....	48.02	28.96	34.98	25.52	31.05	48.82	29.31	35.70	25.80	31.62	54.62	33.26	43.78	29.03	38.16
	New Orleans, La.....	27.35	24.23	30.41	18.96	25.83	33.55	24.05	30.02	18.80	25.52	30.35	25.23	32.41	19.76	27.45
Minneapolis, Minn.....	Duluth, Minn.....	44.61	30.78	36.98	27.42	33.09	45.41	31.13	37.69	27.71	33.68	51.21	35.08	45.77	30.94	40.22
	New Orleans, La.....	38.20	30.11	36.29	24.84	31.71	44.40	29.93	35.90	24.68	31.40	41.20	31.11	38.29	25.64	33.33
	New York, N. Y.....	51.24	42.41	45.63	37.49	42.25	54.34	42.02	44.85	37.18	41.61	55.74	45.22	51.38	39.80	46.87
	Baltimore, Md.....	53.33	40.09	45.07	36.32	41.53	56.43	40.00	44.89	36.24	41.37	57.83	42.49	49.94	38.28	45.46
Minot, N. Dak.....	Duluth, Minn.....	56.81	35.08	41.28	31.72	37.39	57.61	35.43	41.99	32.01	37.98	63.41	39.38	50.07	35.24	44.52
	New Orleans, La.....	60.59	44.02	50.20	38.75	45.62	66.79	43.84	49.81	38.59	45.31	63.59	45.02	52.20	39.55	47.24
	New York, N. Y.....	63.44	55.33	58.56	50.42	55.17	66.54	54.94	57.77	50.10	54.53	67.94	58.14	64.30	52.72	59.79
	Baltimore, Md.....	68.53	53.54	58.52	49.77	54.98	71.63	53.45	58.34	49.69	54.82	73.03	55.94	63.39	51.73	58.91
Omaha, Neb.....	Chicago, Ill.....	49.64	28.96	34.98	25.52	31.05	50.44	29.31	35.70	25.80	31.62	56.24	33.26	43.78	29.03	38.16
	New Orleans, La.....	36.33	28.14	34.32	22.87	29.74	42.52	27.96	33.93	22.71	29.43	39.32	29.14	36.32	23.67	31.36
	Baltimore, Md.....	56.63	41.10	46.08	37.33	42.54	59.73	41.01	45.90	37.25	42.38	61.13	43.50	50.95	39.29	46.47
Shelby, Mont.....	Duluth, Minn.....	77.61	42.36	48.56	39.00	44.67	78.41	42.71	49.27	39.29	45.26	84.21	46.66	57.35	42.52	51.80
	Portland, Oreg.....	61.37	45.92	61.02	40.46	54.19	66.07	45.34	59.62	39.98	53.24	64.97	46.49	61.95	40.12	53.51
St. Louis, Mo.....	Chicago, Ill.....	44.10	27.56	33.58	24.12	29.65	44.90	27.91	34.30	24.40	30.22	50.70	31.86	42.38	27.63	36.74
	New Orleans, La.....	30.33	26.52	32.70	21.25	28.12	36.53	26.34	32.31	21.09	27.81	33.33	27.52	34.70	22.05	29.76
	Baltimore, Md.....	41.89	37.43	42.41	33.66	38.87	44.99	37.34	42.23	33.58	38.71	46.39	39.83	47.28	35.62	42.80
Wichita, Kans.....	Chicago, Ill.....	64.58	37.38	43.40	33.94	39.47	65.38	37.73	44.12	34.22	40.04	71.18	41.68	52.20	37.45	46.58
	New Orleans, La.....	51.52	37.86	44.04	32.59	39.46	57.45	37.68	43.65	37.43	39.15	54.25	38.86	46.04	33.39	41.08

[1] Costs and charges are computed from origin to f.o.b. vessel at port of destination. Costs at destination ports are not included except as these are reflected, in part, by the total in-port time per trip, tables 28, 29, and 61. The costs and charges include the movement from the origin to the port of export by the lowest cost or lowest charge routing, table 75. For hauls by truck, rail, or barge, these are one-way costs or charges. Since no study was made to determine the handling costs, the costs of truck operation, or the cost of operating barges on the New York State Barge Canal-Hudson River route to New York City, the handling, trucking, and barge charges were used in determining both the total charges and the total costs shown below. Over any particular routing, therefore, the costs include the computed transportation costs and the grain handling expenses. The charges are inclusive of transportation and handling but the routings via which the lowest combination of charges were computed are not necessarily the same routings as those where the costs were the lowest. This is indicated in table 75. From the ports of export on the Great Lakes, channel depths limit the volume of grain cargo in the ocean-going vessels and fill-out cargo is added at Montreal. This fill-out cargo is assumed to move in an upper laker vessel from the same origin. Charges for this movement are on a one-way basis but costs for this movement are computed on a round-trip basis, (see below) see table 52. For vessel transportation cost computations, see tables 61 and 63.

[2] Costs and charges also were computed using the U. S. ports on the Great Lakes as origins and Montreal and Seven Islands, Canada, as ports of export, see tables 66 and 67.

[3] For vessel particulars, see table 22.

[4] Total costs (see footnote 1/ above) for a one-way grain movement, together with applicable handling charges, are included.

[5] In computing the round-trip costs, there was added to the one-way costs between origin and port of export, the round-trip vessel costs from port of export to destination and return to the same port of export. The round-trip costs assume that the vessel returns from overseas without payload. All costs have been allocated to the one-way grain movement.

[6] The charge is based on movement by vessels presently in the trade and includes, in addition to handling charges at origin, one handling at a forwarding port, charge for which is estimated at 2.745 cents per bushel.

TABLE 80.--Corn: Estimated total costs for the handling and transportation of corn between selected U. S. origins and selected foreign destinations, with overseas movement in a Liberty-type vessel or in a lake-ocean bulk carrier, and total handling and transportation charges via existing routings, (in cents per bushel) 1957[1]

Origin of corn	Port of export[2]	Destination														
		Rotterdam, Netherlands					Casablanca, Morocco					Santos, Brazil				
		Charges via existing routes	Costs				Charges via existing routes	Costs				Charges via existing routes	Costs			
			Liberty vessel[3]		Lake-ocean[3] bulk carrier			Liberty vessel[3]		Lake-ocean[3] bulk carrier			Liberty vessel[3]		Lake-ocean[3] bulk carrier	
			1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]		1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]		1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.....	Duluth, Minn.	[6] 35.31	22.73	29.37	19.14	25.21	[6] 36.10	23.11	30.13	19.44	25.85	[6] 41.90	27.34	38.79	22.91	32.84
	New York, N. Y.	38.88	35.99	39.44	30.72	35.82	41.98	35.57	38.61	30.39	34.64	43.38	39.00	45.60	33.20	40.77
	Baltimore, Md.	39.57	34.06	39.40	30.03	35.61	42.67	33.97	39.20	29.94	35.44	44.07	36.63	44.61	32.13	39.82
Chicago, Ill.	Chicago, Ill.	[6] 35.31	22.52	28.97	18.84	24.76	[6] 36.11	22.89	29.74	19.14	25.37	[6] 41.91	27.12	38.39	22.59	32.37
	New York, N. Y.	38.88	35.41	38.86	30.14	35.24	41.98	34.99	38.03	29.81	34.06	43.38	38.42	45.02	32.62	40.19
	Baltimore, Md.	39.57	33.39	38.73	29.36	34.94	42.67	33.30	38.53	29.27	34.77	44.07	35.96	43.94	31.46	39.15
Toledo, Ohio	Toledo, Ohio	[6] 29.03	20.78	26.07	17.08	22.07	[6] 29.83	21.16	26.83	17.38	22.68	[6] 35.63	25.50	35.50	20.84	29.68
	New York, N. Y.	34.88	31.82	35.27	26.55	31.65	37.98	31.40	34.44	26.22	30.47	39.38	34.83	41.43	29.03	36.60
	Baltimore, Md.	35.57	29.89	35.66	25.86	38.11	38.67	29.80	35.46	25.77	31.70	40.07	32.46	40.87	27.96	36.08
Cincinnati, Ohio	Chicago, Ill.	54.74	31.58	38.03	27.90	33.82	55.53	31.95	38.80	28.20	34.43	61.33	36.18	47.45	31.65	41.43
	Toledo, Ohio	44.95	31.12	36.41	27.42	32.41	45.75	31.50	37.17	27.72	33.02	51.56	35.84	45.84	31.18	40.02
	New Orleans, La.	35.42	28.52	35.14	22.88	30.24	41.62	28.33	34.73	22.71	29.91	38.42	29.60	37.29	23.74	31.97
	New York, N. Y.	44.41	37.46	40.91	32.19	37.29	47.51	37.04	40.08	31.86	36.11	48.91	40.47	47.07	34.67	42.24
	Baltimore, Md.	43.51	32.97	38.31	28.94	34.52	46.61	32.88	38.11	28.85	34.35	48.01	35.54	43.52	31.04	38.73
Columbus, Ohio	Toledo, Ohio	41.09	29.77	35.06	26.07	31.06	41.89	30.15	35.82	26.37	31.67	47.69	34.49	44.49	29.83	38.67
	New York, N. Y.	44.15	35.63	39.08	30.36	35.46	47.25	35.21	38.25	30.03	34.28	48.65	38.64	45.24	32.84	40.41
	Baltimore, Md.	43.25	31.48	36.82	27.45	33.03	46.35	31.39	36.62	27.36	32.86	47.75	34.05	42.03	29.59	37.21
Decatur, Ill.	Chicago, Ill.	49.75	32.14	38.59	28.46	34.38	50.55	32.57	39.36	28.76	34.99	56.35	36.74	48.01	32.21	41.99
	Toledo, Ohio	46.56	32.75	38.04	29.05	34.04	47.36	33.13	38.80	29.35	34.65	53.16	37.47	47.47	32.81	41.65
	New Orleans, La.	39.21	36.67	43.29	31.03	38.39	45.41	36.48	42.88	30.86	38.06	42.21	37.75	45.44	31.89	40.12
	New York, N. Y.	37.97	40.92	44.37	35.65	40.75	41.07	40.50	43.54	35.32	39.57	42.47	43.93	50.53	38.13	45.70
	Baltimore, Md.	37.07	36.67	42.01	32.64	38.22	41.17	36.58	41.81	32.55	38.05	41.57	39.24	47.22	34.74	42.43
Enid, Okla.	Chicago, Ill.	64.25	40.16	46.61	36.48	42.40	64.78	40.53	47.38	36.78	43.01	70.85	44.76	56.03	40.23	50.01
	New Orleans, La.	50.70	37.29	43.91	31.65	39.01	56.90	37.10	43.50	31.48	38.68	53.70	38.37	46.06	32.51	40.74
Evansville, Ind.	Chicago, Ill.	50.07	30.17	36.62	26.49	32.41	50.87	30.54	37.39	26.79	33.02	56.67	34.77	46.04	30.24	40.02
	Toledo, Ohio	47.95	33.89	39.18	30.19	35.18	48.75	34.27	39.94	30.49	35.79	54.56	38.61	48.61	33.95	42.79
	New Orleans, La.	32.26	27.12	33.74	21.48	28.84	38.46	26.93	33.33	21.31	28.51	35.26	28.20	35.89	22.34	30.57
	New York, N. Y.	46.37	40.91	44.36	35.64	40.74	49.47	40.49	43.53	35.31	39.56	50.87	43.92	50.52	38.12	45.69
	Baltimore, Md.	45.47	36.42	41.76	32.39	37.97	48.57	36.33	41.56	32.30	37.80	49.97	38.99	46.97	34.49	42.18
Fort Dodge, Ia.	Duluth, Minn.	53.47	34.12	40.76	30.53	36.60	54.27	34.50	41.52	30.84	37.23	60.07	38.73	50.18	34.30	44.23
	New Orleans, La.	44.66	41.14	47.76	35.50	42.86	50.86	40.95	47.35	35.33	42.53	47.66	42.22	49.91	36.36	44.59
	New York, N. Y.	60.10	44.12	47.57	38.85	43.95	63.20	43.70	46.74	38.52	42.77	64.60	47.13	53.73	41.33	48.90
	Baltimore, Md.	60.61	40.46	45.80	36.43	42.01	63.71	40.37	45.60	36.34	41.84	65.11	43.03	51.01	38.53	46.22
Garden City, Kan.	Chicago, Ill.	62.24	42.27	48.72	38.59	44.51	63.04	42.64	49.49	38.89	45.12	68.84	46.87	58.14	42.34	52.12
	New Orleans, La.	53.38	40.78	47.40	35.14	42.50	59.58	40.59	46.99	34.97	42.17	56.38	41.86	49.55	36.00	44.23
Indianapolis, Ind.	Chicago, Ill.	50.18	32.36	38.81	28.68	34.60	50.98	32.73	39.58	28.98	35.21	56.78	36.96	48.23	32.43	42.21
	Toledo, Ohio	46.02	31.08	36.37	27.38	32.37	46.82	31.46	37.13	27.68	32.98	52.62	35.80	45.80	31.14	39.98
	New York, N. Y.	44.15	38.33	41.78	33.06	38.16	47.25	37.91	40.95	32.73	36.98	48.65	41.34	47.94	35.54	43.11
	Baltimore, Md.	43.25	34.08	39.42	30.05	35.63	46.35	33.99	39.22	29.96	35.46	47.75	36.65	44.63	32.15	39.84
Kansas City, Mo.	Chicago, Ill.	48.00	30.52	36.97	26.84	32.76	48.80	30.89	37.74	27.14	33.37	54.60	35.12	46.39	30.59	40.37
	New Orleans, La.	34.46	29.67	36.29	24.03	31.39	40.66	29.48	35.88	23.86	31.06	37.46	30.75	38.44	24.89	33.12
	Baltimore, Md.	53.51	40.21	45.55	36.18	41.76	56.61	40.12	45.35	36.09	41.59	58.01	42.78	50.76	38.28	45.97
Kearney, Nsb.	Chicago, Ill.	65.06	38.91	45.36	35.23	41.15	65.86	39.28	46.13	35.53	41.76	71.66	43.51	54.78	38.98	48.76
	New Orleans, La.	51.88	40.94	47.56	35.30	42.66	58.08	40.75	47.15	35.13	42.33	54.88	42.02	49.71	36.16	44.39
	New York, N. Y.	70.47	48.31	51.76	43.04	48.14	73.57	47.89	50.93	42.71	46.96	74.97	51.32	57.92	45.52	53.09
	Baltimore, Md.	69.57	44.43	49.77	40.40	45.98	72.67	44.34	49.57	40.31	45.81	74.07	47.00	54.98	42.50	50.19

See footnotes at end of table.

TABLE 80.--Corn: Estimated total costs for the handling and transportation of corn between selected U. S. origins and selected foreign destinations, with overseas movement in a Liberty-type vessel or in a lake-ocean bulk carrier, and total handling and transportation charges via existing routings, (in cents per bushel) 1957[1]--Continued

Origin of corn	Port of export[2]	Destination: Rotterdam, Netherlands					Casablanca, Morocco					Santos, Brazil				
		Charges via existing routes	Costs: Liberty vessel[3]		Costs: Lake-ocean[3] bulk carrier		Charges via existing routes	Costs: Liberty vessel[3]		Costs: Lake-ocean[3] bulk carrier		Charges via existing routes	Costs: Liberty vessel[3]		Costs: Lake-ocean[3] bulk carrier	
			1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]		1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]		1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]
		Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Limon, Colo.	Chicago, Ill.	72.82	43.24	49.69	39.56	45.48	73.62	43.61	50.46	39.86	46.09	79.42	47.84	59.11	43.31	53.09
	New Orleans, La.	59.27	43.31	49.93	37.67	45.03	65.47	43.12	49.52	37.50	44.70	62.27	44.39	52.08	38.53	46.76
Mankato, Minn.	Duluth, Minn.	53.21	32.54	39.18	28.95	35.02	54.01	32.92	39.94	29.26	35.65	59.81	37.15	48.60	32.72	42.65
	New Orleans, La.	46.02	40.63	47.25	34.99	42.35	52.22	40.44	46.84	34.82	42.02	49.02	41.71	49.40	35.85	44.08
	New York, N. Y.	59.84	52.45	55.90	47.18	52.28	62.94	52.03	55.07	36.93	51.10	64.34	55.46	62.06	49.66	57.23
	Baltimore, Md.	64.13	50.52	55.86	46.49	52.07	67.23	50.43	55.66	46.40	51.90	68.63	53.09	61.07	48.67	56.28
Memphis, Tenn.	Chicago, Ill.	47.31	30.65	37.10	26.97	32.89	48.11	31.02	37.87	27.27	33.50	53.91	35.25	46.52	30.72	40.50
	New Orleans, La.	26.91	25.61	32.23	19.97	27.33	33.11	25.42	31.82	19.80	27.00	29.91	26.69	34.38	20.83	29.06
Minneapolis, Minn.	Duluth, Minn.	44.21	31.83	38.47	28.24	34.31	45.01	32.21	39.23	28.55	34.94	50.81	36.44	47.89	32.01	41.94
	New Orleans, La.	37.16	31.77	38.39	26.13	33.49	43.36	31.58	37.98	25.96	33.16	40.16	32.85	40.54	26.99	35.22
	New York, N. Y.	50.84	43.53	46.98	38.24	43.36	53.94	43.11	46.15	37.93	42.18	55.34	46.54	53.14	40.74	48.31
	Baltimore, Md.	51.07	41.08	46.42	37.05	42.63	54.17	40.99	46.22	36.96	42.46	55.57	43.65	51.63	39.15	46.84
Minot, N. Dak.	Duluth, Minn.	58.19	35.90	42.54	32.31	38.38	58.99	36.28	43.30	32.62	39.01	64.79	40.51	51.96	36.08	46.01
	New Orleans, La.	61.01	45.18	51.80	39.54	46.90	67.21	44.99	51.39	39.37	46.57	64.01	46.26	53.95	40.40	48.63
	New York, N. Y.	64.82	55.81	59.26	50.54	55.64	67.92	55.39	58.45	50.21	54.46	69.32	58.82	65.42	53.02	60.59
	Baltimore, Md.	69.11	53.88	59.22	49.85	55.43	72.21	53.79	59.02	49.76	55.26	73.61	56.45	64.43	51.95	59.64
Omaha, Neb.	Chicago, Ill.	48.82	30.65	37.10	26.97	32.89	49.62	31.02	37.87	27.27	33.50	55.42	35.25	46.52	30.72	40.50
	New Orleans, La.	35.28	29.80	36.42	24.16	31.52	41.48	29.61	36.01	23.99	31.19	38.28	30.88	38.57	25.02	33.25
	Baltimore, Md.	54.15	42.09	47.43	38.06	43.64	57.25	42.00	47.23	37.97	43.47	58.65	44.66	52.64	40.16	47.85
St. Louis, Mo.	Chicago, Ill.	43.71	29.09	35.54	25.41	31.33	44.51	29.46	36.31	25.71	31.94	50.31	33.69	44.96	29.16	38.94
	New Orleans, La.	29.75	28.00	34.62	22.36	29.72	35.95	27.81	34.21	22.19	29.39	32.75	29.08	36.77	23.22	31.45
	Baltimore, Md.	40.35	37.36	42.70	33.33	38.91	43.45	37.27	42.50	33.24	38.74	44.85	39.93	47.91	35.43	43.12
Wichita, Kan.	Chicago, Ill.	64.89	38.72	45.17	35.04	40.96	65.69	39.09	45.94	35.34	41.57	71.49	43.32	54.59	38.79	48.57
	New Orleans, La.	51.34	38.34	44.96	32.70	40.06	57.54	38.15	44.55	32.53	39.73	54.34	39.42	47.11	33.56	41.79

[1] Costs and charges are computed from origin to f.o.b. vessel at port of destination. Costs at destination ports are not included except as these are reflected, in part, by the total in-port time per trip, tables 28, 29, and 61. The costs and charges include the movement from the origin to the port of export by the lowest cost or lowest charge routing, table 76. For hauls by truck, rail, or barge, these are one-way costs or charges. Since no study was made to determine the handling costs, the costs of truck operation, or the cost of operating barges on the New York State Barge Canal-Hudson River route to New York City, the handling, trucking, and barge charges were used in determining both the total charges and the total costs shown below. Over any particular routing, therefore, the costs include the computed transportation costs and the grain handling expenses. The charges are inclusive of transportation and handling but the routings via which the lowest combination of charges were computed are not necessarily the same routings as those where the costs were the lowest. This is indicated in table 76. From the ports of export on the Great Lakes, channel depths limit the volume of grain cargo in the ocean-going vessels and fill-out cargo is added at Montreal. This fill-out cargo is assumed to move in an upper laker vessel from the same origin. Charges for this movement are on a one-way basis but costs for this movement are computed on a round-trip basis, (see below) see table 53. For vessel transportation cost computations, see tables 61 and 64.

[2] Costs and charges also were computed using the U. S. ports on the Great Lakes as origins and Montreal and Seven Islands, Canada, as ports of export, see tables 66 and 67.

[3] For vessel particulars, see table 22.

[4] Total costs (see footnote [1]) above) for a one-way grain movement, together with applicable handling charges, are included.

[5] In computing the round-trip costs, there was added to the one-way costs between origin and port of export, the round-trip vessel costs from port of export to destination and return to the same port of export. The round-trip costs assume that the vessel returns from overseas without payload. All costs have been allocated to the one-way grain movement.

[6] The charge is based on movement by vessels presently in the trade and includes, in addition to handling charges at origin, one handling at a forwarding port, charge for which is estimated at 2.745 cents per bushel.

TABLE 81.--Barley: Estimated total costs for the handling and transportation of barley between selected U.S. origins and selected foreign destinations, with overseas movement in a Liberty-type vessel or in a lake-ocean bulk carrier, and total handling and transportation charges via existing routings, (in cents per bushel) 1957[1]

Origin of barley	Port of export[2]	Destination														
		Rotterdam, Netherlands					Casablanca, Morocco					Santos, Brazil				
		Charges via existing routes	Costs				Charges via existing routes	Costs				Charges via existing routes	Costs			
			Liberty vessel[3]		Lake-ocean bulk carrier[3]			Liberty vessel[3]		Lake-ocean bulk carrier[3]			Liberty vessel[3]		Lake-ocean bulk carrier[3]	
			One-way[4]	Round-trip[5]	One-way[4]	Round-trip[5]		One-way[4]	Round-trip[5]	One-way[4]	Round-trip[5]		One-way[4]	Round trip[5]	One-way[4]	Round trip[5]
		Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Duluth, Minn.....	Duluth, Minn.....	[6] 35.30	26.00	33.75	21.81	28.89	[6] 36.10	26.44	34.63	22.17	29.63	[6] 41.90	31.37	44.73	26.20	37.79
	New York, N. Y.....	38.88	38.87	42.90	32.73	38.67	41.98	28.39	41.92	32.34	37.88	43.38	42.38	50.08	35.61	44.45
	Baltimore, Md.....	39.65	36.63	42.85	31.92	38.42	42.75	36.51	42.62	31.82	38.23	44.15	39.62	48.93	34.37	43.33
Chicago, Ill.....	Chicago, Ill.....	[6] 35.31	25.75	33.27	21.46	28.36	[6] 36.11	26.19	34.17	21.81	29.07	[6] 41.91	31.12	44.26	25.84	37.24
	New York, N. Y.....	38.88	38.10	42.13	31.96	37.90	41.98	37.62	41.15	31.57	37.11	43.38	41.61	49.31	34.84	43.68
	Baltimore, Md.....	39.65	35.86	42.08	31.15	37.65	42.75	35.74	41.85	31.05	37.46	44.15	38.85	48.16	33.60	42.56
Toledo, Ohio.....	Toledo, Ohio.....	[6] 29.03	23.78	29.95	19.45	25.27	[6] 29.83	24.21	30.83	19.80	25.99	[6] 35.63	29.27	40.94	23.84	34.15
	New York, N. Y.....	34.88	34.02	38.05	27.88	33.82	37.98	33.54	37.07	27.49	33.03	39.38	37.53	45.23	30.76	39.60
	Baltimore, Md.....	35.65	31.78	38.00	27.07	33.57	38.75	31.66	37.77	26.97	33.38	40.15	34.78	44.08	29.52	38.48
Cincinnati, Ohio.....	Chicago, Ill.....	52.24	35.97	43.49	31.68	38.58	53.04	36.41	44.39	32.03	39.29	58.84	41.34	54.48	36.06	47.46
	Toledo, Ohio.....	45.29	33.45	39.62	29.12	34.94	46.09	33.88	40.50	29.47	35.66	51.89	38.94	50.61	33.51	43.82
	New Orleans, La.....	33.32	32.48	40.20	25.90	34.48	39.52	32.26	39.72	25.70	34.09	36.32	33.73	42.70	26.90	36.51
	New York, N. Y.....	40.85	38.72	42.75	32.58	38.52	43.95	38.24	41.77	32.19	37.73	45.35	42.23	49.93	35.46	44.30
	Baltimore, Md.....	40.07	34.18	40.40	29.47	35.97	43.17	34.06	40.17	29.37	35.78	44.57	37.17	46.48	31.92	40.88
Columbus, Ohio.....	Toledo, Ohio.....	42.79	32.21	38.38	27.88	33.70	43.59	32.64	39.26	28.23	34.42	49.39	37.70	49.37	32.27	42.58
	New York, N. Y.....	40.59	37.05	41.08	30.91	36.85	43.69	36.57	40.08	30.52	36.06	45.09	40.56	48.26	33.79	42.63
	Baltimore, Md.....	39.81	32.81	39.03	28.10	34.60	42.91	32.69	38.80	28.00	34.41	44.31	35.80	45.11	30.55	39.51
Decatur, Ill.....	Chicago, Ill.....	49.88	34.75	42.27	30.46	37.36	50.68	35.19	43.17	30.81	38.07	56.48	40.12	53.26	34.84	46.24
	Toledo, Ohio.....	49.16	34.88	41.09	30.55	36.37	49.96	35.31	41.93	30.92	37.09	55.76	40.37	52.04	34.94	45.25
	New Orleans, La.....	38.30	39.30	47.02	32.72	41.30	44.50	39.08	46.54	32.52	40.91	41.30	40.55	49.52	33.72	43.33
	New York, N. Y.....	35.33	41.83	45.86	35.69	41.63	38.43	41.35	44.88	35.30	40.84	39.83	45.34	53.04	38.57	47.41
	Baltimore, Md.....	34.55	37.50	43.72	32.79	39.29	37.65	37.38	43.49	32.69	39.10	39.05	40.49	49.80	35.24	44.20
Enid, Okla.....	Chicago, Ill.....	65.26	41.15	48.67	36.86	43.76	66.06	41.59	49.57	37.21	44.47	71.86	46.52	59.66	41.24	52.64
	New Orleans, La.....	51.27	38.74	46.46	32.16	40.74	57.47	38.52	45.98	31.96	40.35	54.27	39.99	48.96	33.16	42.77
Evansville, Ind.....	Chicago, Ill.....	50.59	34.34	41.86	30.05	36.95	51.39	34.78	42.76	30.40	37.66	57.19	39.71	52.85	34.43	45.83
	Toledo, Ohio.....	50.78	35.93	42.10	31.60	37.42	51.58	36.36	42.98	31.95	38.14	57.38	41.42	53.09	35.99	46.30
	New Orleans, La.....	30.61	30.85	38.57	24.27	32.85	36.81	30.63	38.09	24.07	32.46	33.61	32.10	41.07	25.27	34.88
	New York, N. Y.....	42.53	41.82	45.85	35.68	41.62	45.63	41.34	44.87	35.29	40.83	47.03	45.33	53.03	38.56	47.40
	Baltimore, Md.....	41.75	37.27	43.50	32.57	39.07	44.85	37.16	43.27	32.47	38.88	46.25	40.27	49.58	35.02	43.98
Fort Dodge, Ia.....	Duluth, Minn.....	56.14	36.49	44.24	32.30	39.38	56.94	36.93	45.12	32.66	40.12	62.74	41.86	55.22	36.69	48.28
	New Orleans, La.....	45.00	42.60	50.32	36.02	44.60	51.20	42.38	49.84	35.82	44.21	48.00	43.85	52.83	37.02	46.63
	New York, N. Y.....	54.47	43.51	47.54	37.37	43.31	58.57	43.03	46.56	36.98	42.52	59.97	47.02	54.72	40.25	49.09
	Baltimore, Md.....	54.69	39.79	46.01	35.08	41.58	57.79	39.67	45.78	34.98	41.39	59.19	42.78	52.09	37.53	46.49
Garden City, Kan.....	Chicago, Ill.....	65.92	45.38	52.90	41.10	48.00	66.72	45.82	53.80	41.44	48.70	72.52	50.75	63.87	45.47	56.87
	New Orleans, La.....	54.39	41.82	49.54	35.24	43.82	60.59	41.60	49.06	35.04	43.43	57.39	43.07	52.04	36.24	45.85
Indianapolis, Ind.....	Chicago, Ill.....	52.35	34.94	42.46	30.65	37.55	53.15	35.38	43.36	31.00	38.26	58.95	40.31	53.45	35.03	46.43
	Toledo, Ohio.....	46.47	33.38	39.55	29.05	34.87	47.27	33.81	40.43	29.40	35.59	53.07	38.87	50.64	33.44	43.75
	New York, N. Y.....	40.59	39.48	43.51	33.34	39.28	43.69	39.00	42.53	32.95	38.49	45.09	42.99	50.69	36.22	45.06
	Baltimore, Md.....	39.81	35.15	41.37	30.44	36.94	42.91	35.03	41.14	30.34	36.75	44.31	38.14	47.45	32.89	41.85
Kansas City, Mo.....	Chicago, Ill.....	46.61	34.59	42.11	30.30	37.20	47.41	35.03	43.01	30.65	37.91	53.19	39.96	53.10	34.68	46.08
	New Orleans, La.....	32.63	33.66	41.38	27.08	35.66	38.83	33.44	40.91	26.88	35.27	35.63	34.91	43.88	28.08	37.69
	Baltimore, Md.....	48.55	39.52	45.74	34.81	41.31	51.65	39.40	45.51	34.71	41.12	53.05	42.51	51.82	37.26	46.22
Kearney, Neb.....	Chicago, Ill.....	62.99	40.08	47.60	35.79	42.69	63.79	40.52	48.50	36.14	43.40	69.59	45.45	58.59	40.17	51.57
	New Orleans, La.....	49.00	42.53	50.25	35.95	44.53	55.20	42.31	49.77	35.75	44.14	52.00	43.78	52.75	39.95	46.56
	New York, N. Y.....	63.15	47.06	51.09	40.92	46.86	66.25	46.58	50.11	40.53	46.07	67.65	50.57	58.27	43.80	52.64
	Baltimore, Md.....	62.37	43.16	49.38	38.45	44.95	65.47	43.04	49.15	38.35	44.76	66.87	46.15	55.46	40.90	49.86

See footnotes at end of table.

TABLE 81.--Barley: Estimated total costs for the handling and transportation of barley between selected U.S. origins and selected foreign destinations, with overseas movement in a Liberty-type vessel or in a lake-ocean bulk carrier, and total handling and transportation charges via existing routings, (in cents per bushel) 1957[1]--Continued

Origin of barley	Port of export[2]	Destination: Rotterdam, Netherlands					Casablanca, Morocco					Santos Brazil				
		Charges via existing routes	Costs: Liberty vessel[3]		Costs: Lake-ocean bulk carrier[3]		Charges via existing routes	Costs: Liberty vessel[3]		Costs: Lake-ocean bulk carrier[3]		Charges via existing routes	Costs: Liberty vessel[3]		Costs: Lake-ocean bulk carrier[3]	
			One-way[4]	Round-trip[5]	One-way[4]	Round-trip[5]		One-way[4]	Round-trip[5]	One-way[4]	Round-trip[5]		One-way[4]	Round-trip[5]	One-way[4]	Round-trip[5]
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Limon, Colo.....	Chicago, Ill.....	73.55	43.76	51.28	39.47	46.37	74.35	44.20	52.16	39.82	47.08	80.15	49.13	62.27	43.85	55.25
	New Orleans, La.....	59.56	44.51	52.23	37.93	46.51	65.76	44.29	51.75	37.73	46.12	62.56	45.76	54.73	38.93	48.54
Mankato, Minn.....	Duluth, Minn.....	52.99	35.09	42.84	30.90	37.98	53.79	35.53	43.72	31.26	38.72	59.59	40.46	53.82	35.29	46.88
	New Orleans, La.....	45.11	43.76	51.48	37.18	45.76	51.31	43.54	51.00	36.98	45.37	48.11	45.01	53.98	38.18	47.79
	New York, N. Y.....	59.62	54.61	58.64	48.47	54.41	62.72	54.13	57.66	48.08	53.62	64.12	58.12	65.82	51.35	60.19
	Baltimora, Md.....	63.99	52.37	58.59	47.66	54.16	67.09	52.25	58.36	47.56	53.97	68.49	55.36	64.67	50.11	59.07
Memphis, Tenn.....	Chicago, Ill.....	45.88	34.90	42.42	30.61	37.57	46.68	35.34	43.32	30.96	38.22	52.48	40.27	53.41	34.99	46.39
	New Orleans, La.....	26.02	29.08	36.80	22.50	31.08	32.22	28.86	36.32	22.30	30.69	29.02	30.33	39.30	23.50	33.11
Minnaapolis, Minn.....	Duluth, Minn.....	43.41	34.49	42.24	30.30	37.38	44.21	34.93	43.12	30.66	38.12	50.01	39.86	53.22	34.69	46.28
	New Orleans, La.....	35.08	35.96	43.68	29.38	37.96	41.28	35.74	43.20	29.18	37.57	38.08	37.21	46.18	30.38	39.99
	New York, N. Y.....	47.33	43.05	47.08	36.91	42.85	50.43	42.57	46.10	36.52	42.06	51.83	46.56	54.26	39.79	48.63
	Baltimora, Md.....	46.55	40.36	46.58	35.65	42.15	49.65	40.24	46.35	35.55	41.96	51.05	43.35	52.66	38.10	47.06
Minot, N. Dak.....	Duluth, Minn.....	61.63	38.06	45.81	33.87	40.95	62.43	38.50	46.69	34.23	41.69	68.23	43.43	56.79	38.26	49.85
	New Orleans, La.....	61.09	48.20	55.92	41.62	50.20	67.29	47.98	55.44	41.42	49.81	64.09	49.45	58.42	42.62	52.23
	New York, N. Y.....	68.26	57.58	61.61	51.44	57.38	71.36	57.10	60.63	51.05	56.59	72.76	61.09	68.79	54.32	63.16
	Baltimore, Md.....	72.63	55.34	61.56	50.63	57.13	75.73	55.22	61.33	50.53	56.94	77.13	58.33	67.64	53.08	62.04
Omaha, Nab.....	Chicago, Ill.....	47.18	34.90	42.42	30.61	37.51	47.98	35.34	43.32	30.96	38.22	53.78	40.27	53.41	34.99	46.39
	New Orleans, La.....	33.20	33.97	41.69	27.39	35.97	39.40	33.75	41.21	27.19	35.58	36.20	35.22	44.19	28.39	38.00
	Baltimore, Md.....	49.19	41.32	47.44	36.51	43.01	52.29	41.10	47.21	36.41	42.82	53.69	44.21	53.52	38.96	47.92
Shalby, Mont.....	Duluth, Minn.....	77.23	44.19	51.94	40.00	47.08	78.03	44.63	52.82	40.36	47.82	83.83	49.56	62.92	44.39	55.98
	Portland, Orag.....	56.85	49.64	68.50	42.82	59.97	61.55	48.91	66.75	42.22	58.78	60.45	50.35	69.66	42.39	59.12
St. Louis, Mo.....	Chicago, Ill.....	42.94	32.92	40.44	28.63	35.53	43.74	33.36	41.34	28.98	36.24	49.54	38.29	51.43	33.01	44.41
	New Orleans, La.....	28.60	31.71	39.43	25.13	33.71	34.80	31.49	38.95	24.93	33.32	31.60	32.96	41.93	26.13	35.74
	Baltimora, Md.....	37.27	38.06	44.28	33.35	39.85	40.37	37.94	44.05	33.25	39.66	41.77	41.05	50.36	35.80	44.76
Wichita, Kan.....	Chicago, Ill.....	64.67	39.93	47.45	35.64	42.54	65.47	40.37	48.35	35.99	43.25	71.27	45.30	58.44	40.02	51.42
	New Orleans, La.....	50.68	39.66	47.38	33.08	41.66	56.88	39.44	46.90	32.88	41.27	53.68	40.91	49.88	34.08	43.69

[1] Costs and charges are computed from origin to f.o.b. vessel at port of destination. Costs at destination ports are not includad except as these are reflected, in part, by the total in-port time per trip, tables 28, 29 and 61. The costs and charges include the movement from the origin to the port of export by the lowest cost or lowest charge routing, table 77. For hauls by truck, rail, or barge, these are one-way costs or charges. Since no study was made to determine the handling costs, the costs of truck operation, or the cost of operating barges on the New York State Barge Canal-Hudson route to New York City, the handling, trucking, and barge charges were used in determining both the total charges and the total costs shown below. Over any particular routing, therefore, the costs include the computed transportation costs and the grain handling expenses. The charges are inclusive of transportation and handling but the routings via which the lowest combination of charges were computed are not necessarily the same routings as those where the costs were the lowest. This is indicated in table 77. From the ports of export on the Great Lakes, channel depths limit the volume of grain cargo in the ocean-going vessels and fill-out cargo is added at Montreal. This fill-out cargo is assumed to move in an upper laker vessel from the same origin. Charges for this movement are on a one-way basis but costs for this movement are computed on a round-trip basis (see below) see table 54. For vessel transportation cost computations, see tables 61 and 65.

[2] Costs and charges also were computed using the U. S. ports on the Great Lakes as origins and Montreal and Seven Islands, Canada, as ports of export, see tables 66 and 67.

[3] For vessel particulars, saa table 22.

[4] Total costs (see footnote 1 above) for a one-way grain movement, together with applicabla handling charges, are included.

[5] In computing the round-trip costs, there was added to the one-way costs between origin and port of export, the round-trip vessel costs from port of export to destination and return to the same port of export. The round-trip costs assume that the vessel returns from overseas without payload. All costs have been allocated to the one-way grain movement.

[6] The charge is basad on movement by vessels presently in the trade and includes, in addition to handling charges at origin, one handling at a forwarding port, charge for which is estimated at 2.745 cents per bushel.

TABLE 82.--Soybeans: Estimated total costs for the handling and transportation of soybeans between selected U. S. origins and selected foreign destinations, with overseas movement in a Liberty-type vessel or in a lake-ocean bulk carrier, and total handling and transportation charges via existing routings, (in cents per bushel) 1957[1]

Origin of soybeans	Port of export[2]	Destination														
		Rotterdam, Netherlands					Casablanca, Morocco					Santos, Brazil				
		Charges via existing routes	Costs				Charges via existing routes	Costs				Charges via existing routes	Costs			
			Liberty vessel[3]		Lake-ocean bulk carrier[3]			Liberty vessel[3]		Lake-ocean bulk carrier[3]			Liberty vessel[3]		Lake-ocean bulk carrier[3]	
			1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]		1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]		1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.....	**Duluth, Minn.....**	[6] 35.30	21.43	27.63	18.07	23.74	[6] 36.10	21.78	28.34	18.36	24.33	[6] 41.90	25.73	36.42	21.59	30.87
	New York, N. Y.....	38.88	35.12	38.34	30.20	34.96	41.98	34.73	37.56	29.89	34.32	43.38	37.93	44.09	32.51	39.58
	Baltimore, Md.....	40.37	33.33	38.31	29.56	34.77	43.47	33.24	38.13	29.48	34.61	44.87	35.73	43.18	31.52	38.70
Chicago, Ill.....	Chicago, Ill.....	[6] 35.31	21.23	27.25	17.79	23.32	[6] 36.11	21.58	27.97	18.07	23.89	[6] 41.91	25.53	36.05	21.30	30.43
	New York, N. Y.....	38.88	34.50	37.72	29.58	34.34	41.98	34.11	36.94	29.27	33.70	43.38	37.31	43.47	31.89	38.96
	Baltimore, Md.....	40.37	32.71	37.69	28.94	34.15	43.47	35.62	37.51	28.86	33.99	44.87	35.11	42.56	30.90	38.08
Toledo, Ohio.....	Toledo, Ohio.....	[6] 29.03	19.59	24.53	16.13	20.79	[6] 29.83	19.94	25.24	16.41	21.36	[6] 35.63	23.99	33.33	19.64	27.90
	New York, N. Y.....	34.88	31.23	34.45	26.31	31.07	37.98	30.84	33.67	26.00	30.43	39.38	34.04	40.20	28.62	35.69
	Baltimore, Md.....	36.37	29.44	34.42	25.67	30.88	39.47	29.35	34.24	25.59	30.72	40.87	31.84	39.29	27.63	34.81
Cincinnati, Ohio.....	Chicago, Ill.....	55.97	29.82	35.84	26.38	31.91	56.77	30.17	36.56	26.66	32.48	62.57	34.12	44.64	29.89	39.02
	Toledo, Ohio.....	44.02	30.39	35.33	26.93	31.59	44.82	30.74	36.04	27.21	32.16	50.62	34.79	44.13	30.44	38.70
	New Orleans, La.....	36.39	26.95	33.13	21.68	28.55	42.59	26.77	32.74	21.52	28.54	39.39	27.95	35.13	22.48	30.17
	New York, N. Y.....	50.39	37.39	40.61	32.47	37.23	53.49	37.00	39.83	32.16	36.59	54.89	40.20	46.36	34.78	41.85
	Baltimore, Md.....	49.43	32.86	37.84	29.09	34.30	52.53	32.77	37.66	29.01	34.14	53.93	35.26	42.71	31.05	38.23
Columbus, Ohio.....	Toledo, Ohio.....	40.42	28.96	33.90	25.50	30.16	41.22	29.31	34.61	25.78	30.73	47.02	33.36	42.70	29.01	37.27
	New York, N. Y.....	47.13	35.45	38.67	30.53	35.29	50.23	35.06	37.89	30.22	34.65	51.63	38.26	44.42	32.84	39.91
	Baltimore, Md.....	46.17	31.28	36.26	27.51	32.72	49.27	31.19	36.08	27.43	32.56	50.67	33.68	41.13	29.47	36.65
Decatur, Ill.....	Chicago, Ill.....	48.91	31.29	37.31	27.85	33.38	49.71	31.64	38.03	28.13	33.95	55.51	35.59	46.11	31.36	40.49
	Toledo Ohio.....	45.52	32.16	37.10	28.70	33.36	46.32	32.51	37.81	28.98	33.93	52.12	36.56	45.90	32.21	40.47
	New Orleans, La.....	39.46	34.68	40.86	29.41	36.28	45.66	34.50	40.47	29.25	35.97	42.46	35.68	42.86	30.21	37.90
	New York, N. Y.....	45.23	41.10	44.32	36.18	40.94	49.29	40.71	43.54	35.87	40.30	50.69	43.91	50.07	38.49	45.56
	Baltimore, Md.....	45.52	36.81	41.79	33.04	38.25	48.33	36.72	41.61	32.96	36.09	49.73	39.21	46.66	35.00	42.18
Enid, Okla.....	Chicago, Ill.....	63.98	39.68	45.70	36.24	41.77	64.78	40.03	46.42	36.52	42.34	70.58	43.98	54.50	39.75	48.88
	New Orleans, La.....	50.65	37.22	43.40	31.95	38.82	56.85	37.04	43.01	31.79	38.57	53.65	38.22	45.40	32.75	40.44
Evansville, Ind.....	Chicago, Ill.....	49.21	28.51	34.53	25.07	30.60	50.01	28.86	35.25	25.35	31.17	55.81	32.81	43.33	28.58	37.71
	Toledo, Ohio.....	46.82	33.36	38.30	29.90	34.56	47.62	33.71	39.01	30.18	35.13	53.42	37.76	47.10	33.41	41.67
	New Orleans, La.....	33.08	35.64	31.82	20.37	27.24	39.28	25.46	31.43	20.21	26.93	36.08	26.64	33.82	21.17	28.86
	New York, N. Y.....	55.45	41.09	44.31	36.17	40.93	58.55	40.70	43.53	35.86	40.29	59.95	43.90	50.06	38.48	45.55
	Baltimore, Md.....	60.59	36.56	41.54	32.79	38.00	65.69	36.47	41.36	32.71	37.84	67.09	38.96	46.41	34.75	41.93
Fort Dodge, Ia.....	Duluth, Minn.....	52.05	33.49	39.69	30.13	35.80	53.21	33.84	40.40	30.42	36.39	59.01	37.79	48.48	33.65	42.93
	New Orleans, La.....	44.68	38.85	45.03	33.58	40.45	50.88	38.67	44.64	33.42	40.14	47.68	39.85	47.03	34.38	42.08
	New York, N. Y.....	59.04	44.26	47.48	39.34	44.10	62.14	43.87	46.70	39.03	43.46	63.54	47.07	53.23	41.65	48.72
	Baltimore, Md.....	64.13	40.63	45.61	36.86	42.07	67.29	40.54	45.43	36.78	41.91	68.63	43.03	50.48	38.82	46.00
Garden City, Kan.....	Chicago, Ill.....	60.77	41.36	47.38	37.92	43.45	61.57	41.71	48.10	38.20	44.02	67.37	45.66	56.18	41.43	50.56
	New Orleans, La.....	53.15	40.54	46.72	35.27	42.14	59.35	40.36	46.33	35.11	41.83	56.15	41.54	48.72	36.07	43.76
Indianapolis, Ind.....	Chicago, Ill.....	49.31	31.52	37.54	28.08	33.61	50.11	31.87	38.26	28.36	34.18	55.91	35.82	46.34	31.59	40.72
	Toledo, Ohio.....	45.02	30.36	35.30	26.90	31.56	45.82	30.71	36.01	27.18	32.13	51.62	34.76	44.10	30.41	38.67
	New York, N. Y.....	51.93	38.35	41.57	33.43	38.19	55.03	37.96	40.79	33.12	37.55	56.43	41.16	47.32	35.74	42.81
	Baltimore, Md.....	46.17	34.06	39.04	30.29	35.50	49.27	33.97	38.86	30.21	35.34	50.67	36.46	43.91	32.25	39.43
Kansas City, Mo.....	Chicago, Ill.....	48.69	28.90	34.92	25.46	30.99	49.49	29.25	35.64	25.74	31.56	55.29	33.20	43.72	28.97	38.10
	New Orleans, La.....	35.37	28.08	34.26	22.81	29.68	41.57	27.90	33.87	22.65	29.37	38.37	29.08	36.26	23.61	31.30
	Baltimore, Md.....	60.42	40.39	45.37	36.62	41.83	63.52	40.30	45.19	36.54	41.67	64.92	42.79	50.24	38.58	45.76
Kearney, Neb.....	Chicago, Ill.....	63.21	38.35	44.37	34.91	40.44	64.01	38.70	45.09	35.19	41.01	69.81	42.65	53.17	38.42	47.55
	New Orleans, La.....	51.75	40.02	46.20	34.75	41.62	57.95	39.84	45.81	34.59	41.31	54.75	41.02	48.20	35.55	43.24
	New York, N. Y.....	69.84	48.70	51.92	43.78	48.54	72.94	48.31	51.14	43.47	47.90	74.34	51.51	57.67	46.09	53.16
	Baltimore, Md.....	74.93	44.83	49.81	41.06	46.27	78.03	44.74	49.63	40.98	46.11	79.43	47.23	54.68	43.02	50.20

See footnotes at end of table.

TABLE 82.--Soybeans: Estimated total costs for the handling and transportation of soybeans between selected U. S. origins and selected foreign destinations, with overseas movement in a Liberty-type vessel or in a lake-ocean bulk carrier, and total handling and transportation charges via existing routings, (in cents per bushel) 1957[1]--Continued

Origin of soybeans	Port of export[2]	Destination														
		Rotterdam, Netherlands					Casablanca, Morocco					Santos, Brazil				
		Charges via existing routes	Costs				Charges via existing routes	Costs				Charges via existing routes	Costs			
			Liberty vessel[3]		Lake-ocean bulk carrier[3]			Liberty vessel[3]		Lake-ocean bulk carrier[3]			Liberty vessel[3]		Lake-ocean bulk carrier[3]	
			1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]		1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]		1-way[4]	Round-trip[5]	1-way[4]	Round-trip[5]
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Mankato, Minn.....	Duluth, Minn.....	52.16	31.78	37.98	28.42	34.09	52.96	32.13	38.69	28.71	34.68	58.76	36.08	46.77	31.94	41.22
	New Orleans, La.....	46.59	38.50	44.68	33.23	40.10	52.79	38.32	44.29	33.07	39.79	49.59	39.50	46.68	34.03	41.72
	New York, N. Y.....	58.79	52.12	55.34	50.84	51.96	61.89	51.73	54.56	46.89	51.32	63.29	54.93	61.09	49.51	56.58
	Baltimore, Md.....	63.88	50.33	55.31	46.55	51.76	66.98	50.23	55.12	46.47	51.60	68.38	52.72	60.17	48.51	55.69
Memphis, Tenn.....	Chicago, Ill.....	48.02	28.96	34.98	25.52	31.05	48.82	29.31	35.70	25.80	31.62	54.62	33.26	43.78	29.03	38.16
	New Orleans, La.....	27.35	24.23	30.41	18.96	25.83	33.55	24.05	30.02	18.80	25.52	30.35	25.23	32.41	19.76	27.45
Minneapolis, Minn.....	Duluth Minn.....	44.61	30.99	37.19	27.63	33.30	45.41	31.34	37.90	27.92	33.89	51.21	35.29	45.98	31.15	40.43
	New Orleans, La.....	38.20	30.11	36.29	24.84	31.71	44.40	29.93	35.90	24.68	31.40	41.20	31.11	38.29	25.64	33.33
	New York, N. Y.....	51.24	43.62	46.84	38.70	43.46	54.34	43.23	46.06	38.39	42.82	55.74	42.43	52.59	41.01	48.08
	Baltimore, Md.....	56.33	41.27	46.25	37.50	42.71	59.43	41.18	46.07	37.42	42.55	60.83	43.67	51.12	39.46	46.64
Minot, N. Dak.....	Duluth Minn.....	56.81	35.42	41.62	32.06	37.73	57.61	35.77	42.33	32.35	38.32	63.41	39.72	50.41	35.58	44.86
	New Orleans, La.....	60.59	44.39	50.57	39.12	45.99	66.79	44.21	50.18	38.96	45.68	63.59	45.39	52.57	39.92	47.61
	New York, N. Y.....	63.44	55.76	58.98	50.84	55.60	66.54	55.37	58.20	50.53	54.96	67.94	58.57	64.73	53.15	60.22
	Baltimore, Md.....	68.53	53.97	58.95	50.20	55.41	71.63	53.88	58.77	50.12	55.25	73.03	56.37	63.80	52.16	59.34
Omaha, Neb.....	Chicago, Ill.....	49.64	28.96	34.98	25.52	31.05	50.44	29.31	35.70	25.80	31.62	56.24	33.26	43.78	29.03	38.16
	New Orleans, La.....	36.32	28.14	34.32	22.87	29.74	42.52	27.96	33.93	22.71	29.43	39.32	29.14	36.32	23.67	31.36
	Baltimore, Md.....	61.37	42.34	47.32	38.57	43.78	64.47	42.25	47.14	38.49	43.62	65.87	44.74	52.19	40.53	47.71
St. Louis, Mo.....	Chicago, Ill.....	44.10	27.56	33.58	24.12	29.65	44.90	27.91	34.30	24.40	30.22	50.70	31.86	42.38	27.63	36.76
	New Orleans, La.....	30.33	26.52	32.70	21.25	28.12	36.53	26.34	32.31	21.09	27.81	33.33	27.52	34.70	22.05	29.74
	Baltimore, Md.....	48.79	37.61	42.59	33.84	39.05	51.89	35.52	42.41	33.76	38.89	53.29	40.01	47.46	35.80	42.98
Wichita, Kan.....	Chicago, Ill.....	64.58	38.15	44.17	34.71	40.24	65.38	38.50	44.89	34.99	40.81	71.18	42.45	52.97	38.22	47.35
	New Orleans, La.....	51.25	38.36	44.54	33.09	39.96	57.45	38.18	44.15	32.93	39.65	54.25	39.36	46.54	33.89	41.58

[1] Costs and charges are computed from origin to f.o.b. vessel at port of destination. Costs at destination ports are not included except as these are reflected, in part, by the total in-port time per trip, tables 28, 29, and 61. The costs and charges include the movement from the origin to the port of export by the lowest cost or lowest charge routing, table 78. For hauls by truck, rail, or barge, these are one-way costs or charges. Since no study was made to determine the handling costs, the costs of truck operation, or the cost of operating barges on the New York State Barge Canal-Hudson River route to New York City, the handling, trucking, and barge charges were used in determining both the total charges and the total costs shown below. Over any particular routing, therefore, the costs include the computed transportation costs and the grain handling expenses. The charges are inclusive of transportation and handling but the routings via which the lowest combination of charges were computed are not necessarily the same routings as those where the costs were the lowest. This is indicated in table 78. From the ports of export on the Great Lakes, channel depths limit the volume of grain cargo in the ocean-going vessels and fill-out cargo is added at Montreal. This fill-out cargo is assumed to move in an upper laker vessel from the same origin. Charges for this movement are on a one-way basis but costs for this movement are computed on a round-trip basis, (see below) see table 52. For vessel transportation cost computations, see tables 61 and 63.

[2] Costs and charges also were computed using the U. S. ports on the Great Lakes as origins and Montreal and Seven Islands, Canada, as ports of export, see tables 66 and 67.

[3] For vessel particulars, see table 22.

[4] Total costs (see footnote 1 above) for a one-way grain movement, together with applicable handling charges, are included.

[5] In computing the round-trip costs, there was added to the one-way costs between origin and port of export, the round-trip vessel costs from port of export to destination and return to the same port. The round-trip costs assume that the vessel returns from overseas without payload. All costs have been allocated to the one-way grain movement.

[6] The charge is based on movement by vessels presently in the trade and includes, in addition to handling charges at origin, one handling at a forwarding port, charge for which is estimated at 2.745 cents per bushel.

TABLE 83.--Charges and costs of transporting grain, from selected origins to Boston, Mass. for domestic consumption (in cents per bushel) 1957[1]

Origin	Routing by vessels or carriers from origin to destination[2]	Commodity											
		Wheat			Corn			Barley			Soybeans		
		Charges	Costs		Charges	Costs		Charges	Costs		Charges	Costs	
			1-way[3]	Round trip[4]		1-way[3]	Round trip[4]		1-way[3]	Round trip[4]		1-way[3]	Round-trip[4]
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.....	Liberty vessel[5].....	---	27.07	32.13	---	28.60	34.02	---	32.44	38.76	---	27.07	32.13
	Lake-ocean bulk carrier[5].....	---	22.29	26.54	---	23.48	28.03	---	26.46	31.77	---	22.29	26.54
	Upper laker to Buffalo, N. Y.-rail beyond.....	39.84	19.26	21.84	38.24	18.86	21.62	35.04	18.42	21.64	39.84	19.36	21.94
	Upper lake to Oswego, N. Y.-rail beyond.....	38.70	17.48	20.72	37.20	17.22	20.90	34.20	18.08	21.12	38.70	17.56	20.80
Chicago, Ill.....	Liberty vessel[5].....	---	26.77	31.55	---	28.28	33.40	---	32.07	38.04	---	26.77	31.55
	Lake-ocean bulk carrier[5].....	---	21.93	25.96	---	23.09	27.41	---	26.01	31.04	---	21.93	25.96
	Upper laker to Buffalo, N. Y.-rail beyond.....	39.84	18.94	21.22	38.24	18.52	20.96	35.04	18.02	20.86	39.84	19.04	21.32
	Upper laker to Oswego, N. Y.-rail beyond.....	38.70	17.16	20.08	37.20	16.88	20.02	34.20	16.68	20.34	38.70	17.24	20.16
	All rail.....	32.10	19.95	---	29.96	18.83	---	25.68	16.95	---	32.10	20.14	---
Toledo, Ohio.....	Liberty vessel[5].....	---	24.93	28.16	---	26.31	29.77	---	29.77	33.80	---	24.93	28.16
	Lake-ocean bulk carrier[5].....	---	20.29	23.18	---	21.34	24.43	---	23.96	27.57	---	20.29	23.18
	Upper laker to Buffalo, N. Y.-rail beyond.....	35.84	17.30	17.94	34.24	16.78	17.46	31.04	15.98	16.78	35.84	17.40	18.04
	Upper laker to Oswego, N. Y.-rail beyond.....	34.70	15.50	16.78	33.20	15.12	16.48	30.20	14.62	16.20	34.70	15.58	16.86
	All rail.....	32.10	16.50	---	29.96	15.58	---	25.68	14.03	---	32.10	16.65	---

[1] The charges and costs include, in addition to transportation, any applicable grain handling at transfer points. They do not include handling at origin. Since cost data covering handling were not available, handling expenses (table 27) are included in both charges and costs. The rail cost data reflect out-of-pocket costs and with rail charges are shown in table 34; for costs of moving grains in a Liberty-type vessel and in a lake-ocean bulk carrier, see tables 63, 64, and 65; in an "upper laker," see tables 52, 53, and 54. Charges for "upper laker" movements are shown in table 43.

[2] For vessel particulars, see table 22.

[3] The one-way costs reflect the allocation of only the one-way trip expenses between origin and destination.

[4] The round-trip costs reflect the allocation of the round-trip vessel expenses between origin and destination. They assume that the vessel returns to the port of origin without payload.

[5] The vessel moves from the origin port loaded to 25-1/2-foot draft. Fill-out cargo is taken on at Montreal, Can., to bring the vessel down to full draft. It is assumed that the fill-out cargo for any particular vessel moved from the same origin in an "upper laker" to Montreal. Costs for this movement are computed on a round-trip basis. These costs, together with handling charges at Montreal, are included in the total costs for movement from origin to destination.

TABLE 84.--Charges and costs of transporting grain from selected origins to New York, N. Y. for domestic consumption (in cents per bushel) 1957[1]

Origin	Routing by vessels or carriers from origin to destination[2]	Commodity											
		Wheat			Corn			Barley			Soybeans		
		Charges	Costs		Charges	Costs		Charges	Costs		Charges	Costs	
			1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.....	Liberty vessel[5].....	---	27.62	33.25	---	29.19	35.22	---	33.13	40.16	---	27.62	33.25
	Lake-ocean bulk carrier[5].....	---	22.71	27.38	---	23.93	28.93	---	26.98	32.82	---	22.71	27.38
	Upper laker to Buffalo, N. Y.-rail beyond.....	36.54	18.04	20.62	35.16	17.72	20.48	32.41	17.38	20.60	36.54	18.14	20.72
	Upper laker to Buffalo, N. Y.-barge beyond.....	27.82	21.56	24.14	27.82	21.82	24.58	27.82	22.48	25.70	27.82	21.56	24.14
	Upper laker to Oswego, N. Y.-rail beyond.....	35.10	17.22	20.46	33.84	16.98	20.46	31.32	16.86	20.90	35.10	17.30	20.54
	Upper laker to Oswego, N. Y.-barge beyond.....	26.92	20.32	23.56	26.92	20.62	24.10	26.92	21.42	25.46	26.92	20.32	23.56
	All rail.....	45.90	21.32	---	42.84	21.34	---	36.72	18.06	---	45.90	22.54	---
Chicago, Ill.....	Liberty vessel[5].....	---	27.33	32.69	---	28.88	34.62	---	32.77	39.46	---	27.33	32.69
	Lake-ocean bulk carrier[5].....	---	22.34	26.78	---	23.53	28.29	---	26.52	32.07	---	22.34	26.78
	Upper laker to Buffalo, N. Y.-rail beyond.....	36.54	17.74	20.00	35.16	17.38	19.82	32.41	17.00	19.84	36.54	17.82	20.10
	Upper laker to Buffalo, N. Y.-barge beyond.....	27.82	21.24	23.52	27.82	21.48	23.92	27.82	22.10	24.94	27.82	20.00	22.92
	Upper laker to Oswego, N. Y.-rail beyond.....	36.10	16.90	19.84	33.84	16.64	19.78	31.32	16.46	20.12	36.10	16.98	19.90
	Upper laker to Oswego, N. Y.-barge beyond.....	26.92	20.00	22.92	26.92	20.28	23.42	26.92	21.02	24.68	26.92	20.00	22.92
	All rail.....	30.90	18.61	---	28.84	17.57	---	24.72	15.82	---	30.90	18.79	---
Toledo, Ohio.....	Liberty vessel[5].....	---	25.48	29.26	---	26.90	30.94	---	30.45	35.18	---	25.48	29.26
	Lake-ocean bulk carrier[5].....	---	20.69	23.98	---	21.76	25.29	---	24.46	28.57	---	20.69	23.98
	Upper laker to Buffalo, N. Y.-rail beyond.....	32.54	16.10	16.74	31.16	15.64	16.32	28.40	14.96	15.76	32.54	16.18	16.76
	Upper laker to Buffalo, N. Y.-barge beyond.....	23.82	19.60	20.24	23.82	19.74	20.42	23.82	20.06	20.86	23.82	19.60	20.24
	Upper laker to Oswego, N. Y.-rail beyond.....	31.10	15.26	16.52	29.84	14.88	16.24	27.32	14.41	15.98	31.10	15.32	16.60
	Upper laker to Oswego, N. Y.-barge beyond.....	22.92	18.34	19.62	22.92	18.52	19.88	22.92	18.96	20.54	22.92	18.34	19.62
	All rail.....	30.90	15.03	---	28.84	14.20	---	24.72	12.79	---	30.90	15.17	---
Kansas City, Mo..	Barge to Chicago, Ill. - Liberty vessel beyond[5].....	---	35.64	41.00	---	37.52	43.26	---	42.24	48.93	---	35.64	41.00
	Barge to Chicago, Ill. - Lake-ocean bulk carrier beyond[5]..	---	30.08	34.09	---	31.57	35.87	---	35.31	40.31	---	30.08	34.09
	Barge to New Orleans, La. - Liberty vessel beyond.....	---	31.20	33.20	---	32.80	34.94	---	36.79	39.28	---	31.20	33.20
	Barge to New Orleans, La. - Lake-ocean bulk carrier beyond	---	25.25	28.74	---	26.43	29.87	--	29.37	33.39	---	25.25	28.74
	All rail.....	49.20	22.57	---	45.92	22.58	---	39.36	19.12	---	49.20	23.86	---

[1] The charges and costs include, in addition to transportation, any applicable grain handling at transfer points. They do not include handling at origin. Cost data covering handling and cost data covering barge operations on the New York State Barge Canal were not available. In the absence of these, handling expenses (table 27) are included in both charges and costs, and charges for grain transportation on the New York State Barge Canal also are included in computing the charges and the costs. The rail cost data reflect out-of-pocket costs and with rail charges are shown in table 34; for costs of moving grains in a Liberty vessel and in a lake-ocean bulk carrier, see tables 63, 64, and 65; in an "upper laker," see tables 52, 53, and 54. Charges for "upper laker" and barge movements are shown in tables 41 and 43.

[2] For vessel particulars, see table 22.

[3] The one-way costs reflect the allocation of only the one-way trip vessel expenses between origin and destination.

[4] The round-trip costs reflect the allocation of the round-trip vessel expenses, except in the case of barge transportation, between origin and destination. They assume that the vessel returns to the port of origin without payload. Barge costs include only the one-way trip expenses.

[5] The vessel moves from the origin port loaded to 25-1/2-foot draft. Fill-out cargo is taken on at Montreal, Can., to bring the vessel down to full draft. It is assumed that the fill-out cargo for any particular vessel moved from the same origin in any "upper laker" to Montreal. Costs for this movement are computed on a round-trip basis. These costs, together with handling charges at Montreal, are included in the total costs for movement from origin to destination.

TABLE 85.--Charges and costs of transporting grain from selected origins to Baltimore, Md. for domestic consumption (in cents per bushel) 1957[1]

Origin	Routing by vessels or carriers from origin to destination[2]	Commodity											
		Wheat			Corn			Barley			Soybeans		
		Charges	Costs		Charges	Costs		Charges	Costs		Charges	Costs	
			1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]
		Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Duluth, Minn.....	Liberty vessel[5].....	---	28.43	34.88	---	30.06	36.96	---	34.14	42.20	---	28.43	34.88
	Lake-ocean bulk carrier[5].....	---	23.30	28.58	---	24.56	30.21	---	27.72	34.32	---	23.30	28.58
	Upper laker to Buffalo, N. Y. - rail beyond.....	36.54	18.11	20.70	35.16	17.78	20.54	32.40	17.44	20.66	36.54	18.20	20.78
	Upper laker to Oswego, N. Y. - rail beyond.....	---	18.40	21.64	---	18.10	21.56	---	17.86	21.90	---	18.48	21.72
	All rail.....	44.10	21.16	---	41.16	21.18	---	35.28	17.93	---	44.10	22.37	---
Chicago, Ill.....	Liberty vessel[5].....	---	28.17	34.40	---	29.78	36.45	---	33.81	41.60	---	28.17	34.40
	Lake-ocean bulk carrier[5].....	---	22.97	28.05	---	24.21	29.65	---	27.31	33.65	---	22.97	28.05
	Upper laker to Buffalo, N. Y. - rail beyond.....	36.54	17.80	20.08	35.16	17.44	19.88	32.40	17.06	19.90	36.54	17.90	20.16
	Upper laker to Oswego, N. Y. - rail beyond.....	---	18.08	21.00	---	17.76	20,90	---	17.46	21.12	---	18.16	21.10
	All rail.....	29.10	16.74	---	27.16	15.70	---	23.28	14.14	---	29.10	16.78	---
Toledo, Ohio.....	Liberty vessel[5].....	---	26.32	30.97	---	27.80	30.79	---	31.50	37.31	---	26.32	30.97
	Lake-ocean bulk carrier[5].....	---	21.32	25.25	---	22.44	26.65	---	25.25	30.16	---	21.32	25.25
	Upper laker to Buffalo, N. Y. - rail beyond.....	32.54	16.16	16.80	31.16	15.70	16.38	28.40	15.02	15.82	32.54	16.26	16.90
	Upper laker to Oswego, N. Y. - rail beyond.....	---	16.42	17.70	---	15.98	17.34	---	15.40	16.98	---	16.52	17.78
	All rail.....	29.10	13.10	---	27.16	12.37	---	23.28	11.15	---	29.10	13.21	---
Kansas City, Mo..	Barge to Chicago, Ill. - Liberty vessel beyond[5].....	---	36.48	42.71	---	38.42	45.09	---	43.28	51.07	---	36.48	42.71
	Barge to Chicago, Ill. - Lake-ocean bulk carrier beyond[5]...	---	31.27	36.35	---	32.85	38.29	---	36.79	43.13	---	31.27	36.35
	Barge to New Orleans, La. - Liberty vessel beyond.....	---	30.97	32.76	---	32.55	34.47	---	36.50	38.73	---	30.97	32.76
	Barge to New Orleans, La. - Lake-ocean bulk carrier beyond.....	---	25.10	28.15	---	26.27	29.54	---	29.18	32.99	---	25.10	28.15
	All rail.....	47.40	20.41	---	44.24	20.43	---	37.92	17.29	---	47.40	21.58	---

[1] The charges and costs include, in addition to transportstion, any applicable grain handling at transfer points. They do not include origin handling. Since cost data covering handling were not svailable, handling expenses (table 27) are included in both charges and costs. The rail cost dsts reflect out-of-pocket costs and with rsil charges are shown in table 34; for costs of moving grains in s Liberty vessel and in s lake-ocean bulk carrier, see tables 63, 64, and 65; and in an "upper laker," see tables 52, 53, and 54. Charges for "upper laker" and barge movements are shown in tables 41 and 43.

[2] For vessel particulars, see table 22.

[3] The one-way costs reflect the allocation of only the one-way trip expenses between origin and destinstion.

[4] The round-trip costs reflect the allocation of the round-trip vessel expenses, except in the case of barge transportstion, between origin and destinstion. They assume thst the vessel returns to ths port of origin without payload. Barge costs include only the one-way trip expenses.

[5] The vessel moves from the origin port loaded to 25 1/2-foot draft. Fill-out cargo is taken on at Montreal, Can., to bring the vessel down to full draft. It is assumed thst the fill-out cargo for any particular vessel moved from the same origin in an "upper laker" to Montreal. Costs for this movement are computed on a round-trip bssis. These costs, together with handling chargss at Montresl, are included in the total costs for movement from origin to destination.

TABLE 86.--Charges and costs for transporting grain from selected origins to Wilmington, N. C. for domestic consumption (in cents per bushel) 1957[1]

Origin	Routing by vessels or carriers from origin to destination[2]	Commodity											
		Wheat			Corn			Barley			Soybeans		
		Charges	Costs		Charges	Costs		Charges	Costs		Charges	Costs	
			1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.....	Liberty vassal[5].....	---	28.82	35.68	---	30.47	37.82	---	34.63	43.19	---	28.82	35.68
	Lake-ocean bulk carrier[5].....	---	23.58	29.14	---	24.86	30.81	---	28.07	35.02	---	23.58	29.14
	Upper laker to Buffalo, N. Y. rail beyond.....	61.90	23.54	26.12	58.68	23.28	26.04	52.24	22.22	25.44	61.90	23.89	26.46
	All rail.....	69.60	22.28	---	64.96	22.88	---	55.68	19.38	---	69.60	23.14	---
Chicago, Ill.....	Liberty vessel[5].....	---	28.53	35.14	---	30.16	37.24	---	34.26	42.52	---	28.53	35.14
	Lake-ocean bulk carriar[5].....	---	23.22	28.56	---	24.47	30.19	---	27.62	34.29	---	23.22	28.56
	Upper laker to Buffalo, N. Y.- rail beyond.....	61.90	23.24	25.50	58.68	22.94	25.36	52.24	21.84	24.68	61.90	23.58	25.84
	Barge to New Orleans, La.- Liberty vassel beyond.....	---	30.17	30.95	---	31.69	32.53	---	35.50	36.47	---	30.17	30.95
	Barge to New Orleans, La.- Laka-ocean bulk carrier bayond	---	24.54	26.88	---	25.66	28.18	---	28.07	30.99	---	24.54	26.88
	Barge to Memphis, Tenn. - rail beyond.....	51.28	22.54	---	48.07	22.28	---	41.64	20.02	---	51.28	23.19	---
	Barge to Guntersville, Ala.- rail beyond.....	72.08	21.22	---	67.48	21.22	---	58.29	19.90	---	72.08	21.74	---
	Barge to Guntersville, Ala.- truck beyond.....	39.18	31.38	---	39.86	33.40	---	44.06	38.50	---	39.18	31.38	---
	Barge to Chattanooga, Tenn.- rail beyond.....	67.29	20.26	---	63.01	20.36	---	54.45	19.46	---	67.29	20.71	---
	Barge to Chattanooga, Tann.- truck beyond.....	38.68	30.34	---	39.16	32.28	---	40.88	37.18	---	38.68	30.34	---
	All rail.....	56.40	18.42	---	52.64	17.81	---	45.12	15.85	---	56.40	18.81	---
Tolado, Ohio.....	Liberty vessel[5].....	---	26.67	31.68	---	28.17	33.54	---	31.94	38.20	---	26.67	31.68
	Lake-ocean bulk carrier[5].....	---	21.93	25.76	---	22.71	27.19	---	25.56	30.79	---	21.93	25.76
	Upper laker to Buffalo, N. Y.- rail bayond.....	57.90	21.60	22.24	54.68	21.18	21.86	48.24	19.80	20.60	57.90	21.94	22.58
	All rail.....	55.80	16.06	---	52.08	15.53	---	44.64	13.83	---	55.80	16.40	---
Kaneas City, Mo.	Barga to New Orleane, Le.- Liberty vessel beyond.....	---	30.01	30.79	---	31.52	32.36	---	35.30	36.27	---	30.01	30.29
	Barge to New Orleans, Le.- Lake-ocean bulk carrier beyond	---	24.38	26.72	---	25.50	28.00	---	28.28	31.20	---	24.38	26.72
	Barge to Chicago, Ill.- Liberty vessel beyond[5].....	---	36.84	43.45	---	38.80	45.88	---	43.73	51.99	---	36.84	43.45
	Barga to Chicago, Ill. - Lake-ocean bulk carrier beyond[5]...	---	31.53	36.86	---	33.11	38.83	---	37.10	43.77	---	31.53	36.86
	Barge to Memphie, Tann. - rail beyond.....	52.54	22.37	---	49.24	22.10	---	42.66	19.81	---	52.54	23.02	---
	Barge to Guntereville, Ala. - rail beyond.....	72.42	21.06	---	67.80	21.05	---	58.56	19.70	---	72.42	21.58	---
	Barge to Guntersville, Ala. - truck beyond.....	39.52	31.22	---	40.18	33.22	---	42.33	38.30	---	39.52	31.22	---
	Barga to Chattanooga, Tenn. - rail beyond.....	67.72	20.10	---	63.41	20.19	---	54.80	19.26	---	67.72	20.55	---
	Barga to Chattanooga, Tenn. - truck bayond.....	39.12	30.18	---	39.56	32.12	---	41.24	36.98	---	39.12	30.18	---
	All rail.....	72.60	20.73	---	67.76	21.27	---	58.08	18.03	---	72.60	21.51	---
Cincinnati, Ohio.	Barge to New Orleans, La.- Liberty vessal beyond.....	---	29.82	30.60	---	31.31	32.15	---	35.06	36.03	---	29.82	30.60
	Barge to New Orleans, La. - Lake-ocean bulk carrier beyond	---	24.19	26.53	---	25.28	27.80	---	28.04	30.96	---	24.19	26.53
	Barga to Gunterevilla, Ala. - rail beyond.....	68.80	20.40	---	64.42	20.35	---	55.66	18.87	---	68.80	20.92	---
	Barge to Guntersville, Ala. - truck beyond.....	35.90	30.56	---	36.80	32.52	---	39.43	37.46	---	35.90	30.56	---
	Barge to Chattanooga, Tenn. - rail beyond.....	63.67	19.45	---	59.45	19.49	---	51.56	18.45	---	63.67	19.90	---
	Barge to Chattanooga, Tenn. - truck beyond.....	35.06	29.52	---	35.78	31.42	---	38.00	36.18	---	35.06	29.52	---
	All rail.....	39.60	12.92	---	36.96	12.46	---	31.68	9.93	---	39.60	13.46	---

See footnotee at end of table.

TABLE 86.--Charges and costs for transporting grain from selected origins to Wilmington, N. C. for domestic consumption (in cents per bushel) 1957[1]--Continued

Origin	Routing by vessels or carriers from origin to destination[2]	Commodity											
		Wheat			Corn			Barley			Soybsans		
		Charges	Costs		Charges	Costs		Charges	Costs		Charges	Costs	
			1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Evansville, Ind.	Barge to New Orleans, La. - Liberty vessel beyond.....	---	28.57	29.29	---	29.91	30.75	---	33.43	34.40	---	28.51	29.29
	Barge to New Orleans, La. - Lake-ocean bulk carrier beyond	---	22.88	25.22	---	23.88	26.40	---	26.41	29.33	---	22.88	25.22
	Barge to Guntersville, Ala. - rail beyond.....	65.65	19.09	---	61.48	18.94	---	53.14	17.24	---	65.65	19.61	---
	Barge to Guntersville, Ala. - truck beyond.....	32.74	29.24	---	33.86	31.12	---	36.90	35.84	---	32.74	29.24	---
	Barge to Chattanooga, Tenn. - rail beyond.....	60.88	18.14	---	57.03	18.09	---	49.32	16.82	---	61.10	18.81	---
	Barge to Chattanooga, Tenn. - truck beyond.....	32.28	28.22	---	33.18	30.02	---	35.76	34.54	---	32.28	28.22	---
	All rail.....	43.50	14.53	---	40.60	14.01	---	34.80	11.17	---	43.50	15.14	---
Minneapolis, Minn.	Barge to New Orleans, La. - Liberty vessel beyond.....	---	31.10	31.88	---	32.68	33.52	---	36.66	37.63	---	31.10	31.88
	Barge to New Orleans, La. - Lake-ocean bulk carrier beyond	---	25.47	27.81	---	26.66	29.16	---	29.64	32.56	---	25.47	27.81
	Barge to Memphis, Tenn. - rail beyond.....	54.18	23.47	---	50.78	23.28	---	43.96	21.18	---	54.18	24.12	---
	Barge to Guntersville, Ala. - rail beyond.....	73.72	22.15	---	69.01	22.22	---	59.60	21.06	---	73.72	22.67	---
	Barge to Guntersville, Ala. - truck beyond.....	40.82	32.30	---	41.38	34.40	---	43.36	39.66	---	40.82	32.30	---
	Barge to Chattanooga, Tenn. - rail beyond.....	69.02	21.20	---	64.62	21.37	---	55.83	20.64	---	69.02	21.65	---
	Barge to Chattanooga, Tenn. - truck beyond.....	40.42	31.28	---	40.78	33.30	---	42.26	38.36	---	40.42	31.28	---
	All rail.....	69.60	21.54	---	64.96	22.12	---	55.68	18.73	---	69.60	22.37	---

[1] The charges and costs include, in addition to transportation, any applicable grain handling at transfer points. They do not include handling at origin. Cost data covering handling, trucking, and barge operations on the New York State Barge Canal were not available. In the absence of these, handling expenses, table 27, are included in both charges and costs; trucking charges, shown graphically in figures 9 and 10, are included in charges and costs; and charges for grain transportation on the New York State Barge Canal also are included in computing the charges and the costs. The rail cost data reflect the out-of-pocket costs and with rail charges are shown in table 34; for costs of moving grains in a Liberty vessel and in a lake-ocean bulk carrier, see tables 63, 64, and 65; and in an "upper laker," see tsbles 52, 53, and 54. Charges for upper laker and barge movements are shown in tables 41 and 43.

[2] For vessel particulars, see table 22.

[3] The one-way costs reflect the allocation of only the one-way trip expenses between origin and destination.

[4] The round-trip costs reflect the allocation of the round-trip vessel expenses, except in the case of barge transportation, between origin and destinstion. They sssume that the vessel returns to the port of origin without payload. Barge costs and charges for the one-way trip are included.

[5] The vessel moves from the origin port loaded to 25 1/2-foot draft. Fill-out cargo is taken on at Montresl, Can., to bring the vessel down to full draft. It is sssumed ‡hat the fill-out cargo for any particular vessel moved from the same origin, as the balance of the cargo, in an "upper laker" to Montresl. Costs for this movement are computed on a round-trip basis. The costs, together with handling charges at Montreal, are included in the total costs for movement from origin to destination.

TABLE 87.--Charges and costs for transporting grain from selected origins to Savannah, Ga. for domestic consumption (in cents per bushel) 1957[1]

Origin	Routing by vessels or carriers from origin to destination[2]	Commodity											
		Wheat			Corn			Barley			Soybeans		
		Charges	Costs		Charges	Costs		Charges	Costs		Charges	Costs	
			1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]
		Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Duluth, Minn.....	Liberty vessel[5].....	---	29.09	36.22	---	30.76	38.40	---	34.96	43.87	---	29.09	36.22
	Lake-ocean bulk carrier[5].....	---	23.75	29.54	---	25.07	31.24	---	28.32	35.52	---	23.75	29.54
	Upper laker to Buffalo, N. Y. - rail beyond.....	83.80	27.16	29.74	79.12	26.76	29.52	69.76	25.32	28.54	83.80	27.58	30.16
	All rail.....	67.50	22.25	---	63.00	22.84	---	54.00	19.35	---	67.50	23.11	---
Chicago, Ill.....	Liberty vessel[5].....	---	28.80	35.68	---	30.45	37.82	---	34.60	43.19	---	28.80	35.68
	Lake-ocean bulk carrier[5].....	---	23.43	28.98	---	24.70	30.64	---	27.88	34.82	---	23.43	28.98
	Upper laker to Buffalo, N. Y. - rail beyond.....	83.80	26.84	29.12	79.12	26.42	28.86	69.76	24.92	27.76	83.80	27.76	29.54
	Barge to New Orleans, La. - Liberty vessel beyond.....	---	29.85	30.29	---	31.35	31.82	---	35.10	35.65	---	29.85	30.29
	Barge to New Orleans, La. - Lake-ocean bulk carrier beyond.....	---	24.30	26.40	---	25.40	27.65	---	28.18	30.80	---	24.30	26.40
	Barge to Memphis, Tenn. - rail beyond.....	49.18	20.17	---	46.11	20.00	---	39.96	18.19	---	49.18	20.72	---
	Barge to Guntersville, Ala. - rail beyond.....	60.38	17.65	---	56.56	17.78	---	48.93	17.14	---	60.38	18.02	---
	Barge to Guntersville, Ala. - truck beyond.....	33.18	25.38	---	33.44	26.98	---	34.56	31.00	---	33.18	25.38	---
	Barge to Chattanooga, Tenn. - rail beyond.....	57.99	18.00	---	54.33	18.19	---	47.01	17.73	---	57.99	18.36	---
	Barge to Chattanooga, Tenn. - truck beyond.....	33.48	25.14	---	33.60	26.72	---	34.40	30.70	---	33.48	25.24	---
	All rail.....	54.30	18.39	---	50.60	17.78	---	43.44	15.83	---	54.30	18.78	---
Toledo, Ohio.....	Liberty vessel[5].....	---	26.95	32.25	---	28.47	34.15	---	32.29	38.91	---	26.95	32.25
	Lake-ocean bulk carrier[5].....	---	20.97	26.18	---	22.06	27.64	---	25.53	31.32	---	20.97	26.18
	Upper-laker to Buffalo, N. Y. - rail beyond.....	79.80	26.20	25.84	75.12	24.68	25.36	65.76	22.88	23.68	79.80	25.62	26.26
	All rail.....	53.70	16.93	---	50.12	16.37	---	42.96	14.58	---	53.70	17.29	---
Kansas City, Mo...	Barge to New Orleans, La. - Liberty vessel beyond.....	---	29.69	30.13	---	31.18	31.65	---	34.90	35.45	---	29.69	30.13
	Barge to New Orleans, La. - Lake-ocean bulk carrier beyond.....	---	24.14	26.24	---	25.24	27.49	---	27.98	30.60	---	24.14	26.24
	Barge to Chicago, Ill. - Liberty vessel beyond[5].....	---	37.11	43.99	---	39.09	46.46	---	44.07	52.66	---	37.11	43.99
	Barge to Chicago, Ill. - Lake-ocean bulk carrier beyond[5]...	---	31.74	37.28	---	33.34	39.28	---	37.36	44.30	---	31.74	37.28
	Barge to Memphis, Tenn. - rail beyond.....	50.44	20.00	---	47.28	19.82	---	40.98	17.98	---	55.31	20.55	---
	Barge to Guntersville, Ala. - rail beyond.....	60.72	17.49	---	56.88	17.61	---	49.20	16.94	---	60.72	17.86	---
	Barge to Guntersville, Ala. - truck beyond.....	33.52	25.22	---	33.76	26.80	---	34.82	30.80	---	33.52	25.22	---
	Barge to Chattanooga, Tenn. - rail beyond.....	58.42	17.84	---	54.73	18.02	---	47.36	17.53	---	58.42	18.20	---
	Barge to Chattanooga, Tenn. - truck beyond.....	33.92	24.98	---	34.00	26.54	---	34.74	30.50	---	33.92	24.98	---
	All rail.....	70.50	19.07	---	65.80	19.60	---	56.40	16.60	---	70.50	19.81	---
Cincinnati, Ohio..	Barge to New Orleans, La. - Liberty vessel beyond.....	---	29.50	29.94	---	30.97	31.44	---	34.66	35.22	---	29.50	29.94
	Barge to New Orleans, La. - Lake-ocean bulk carrier beyond.....	---	23.95	26.05	---	25.02	27.27	---	27.74	30.36	---	23.95	26.05
	Barge to Guntersville, Ala. - rail beyond.....	57.10	16.83	---	53.50	16.91	---	46.30	16.11	---	57.10	17.20	---
	Barge to Guntersville, Ala. - truck beyond.....	29.90	24.56	---	30.38	26.12	---	31.92	29.96	---	29.90	24.56	---
	Barge to Chattanooga, Tenn. - rail beyond.....	54.37	17.19	---	50.95	17.32	---	44.12	16.72	---	54.37	17.55	---

See footnotes at end of table.

TABLE 87.--Charges and costs for transporting grain from selected origins to Savannah, Ga. for domestic consumption (in cents per bushel) 1957[1]--Continued

Origin	Routing by vessels or carriers from origin to destination[2]	Commodity											
		Wheat			Corn			Barley			Soybeans		
		Charges	Costs		Charges	Costs		Charges	Costs		Charges	Costs	
			1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]		1-way[3]	Round-trip[4]
		Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Cincinnati, Ohio--Con.	Barge to Chattanooga, Tenn. - truck beyond	29.86	24.32	---	30.22	25.84	---	31.50	30.28	---	29.86	24.32	---
	All rail	37.50	12.69	---	35.00	12.24	---	30.00	9.75	---	37.50	13.23	---
Evansville, Ind.	Barge to New Orleans, La. - Liberty vessel beyond	---	28.19	28.63	---	29.57	30.04	---	33.03	33.58	---	28.19	28.63
	Barge to New Orleans, La. - Lake-ocean bulk carrier beyond	---	22.64	24.74	---	23.62	25.87	---	26.11	28.73	---	22.64	24.74
	Barge to Guntersville, Ala. - rail beyond	53.95	15.52	---	50.56	15.50	---	43.78	14.48	---	53.95	15.89	---
	Barge to Guntersville, Ala. - truck beyond	26.74	23.24	---	27.44	24.70	---	29.40	28.34	---	26.74	23.24	---
	Barge to Chattanooga, Tenn. - rail beyond	51.58	15.88	---	48.35	14.92	---	41.88	15.09	---	51.58	17.24	---
	Barge to Chattanooga, Tenn. - truck beyond	27.08	23.02	---	27.62	24.44	---	29.26	28.06	---	27.68	23.02	---
	All rail	41.40	12.58	---	38.64	12.14	---	33.12	9.67	---	41.40	13.12	---
Minneapolis, Minn.	Barge to New Orleans, La. - Liberty vessel beyond	---	30.78	31.22	---	32.34	32.81	---	36.26	36.81	---	30.78	31.22
	Barge to New Orleans, La. - Lake-ocean bulk carrier beyond	---	25.23	27.33	---	26.40	28.65	---	29.34	31.96	---	25.23	27.33
	Barge to Memphis, Tenn. - rail beyond	52.08	21.10	---	48.82	21.00	---	42.28	19.35	---	52.08	21.65	---
	Barge to Guntersville, Ala. - rail beyond	62.08	18.58	---	58.09	18.78	---	50.24	18.30	---	62.02	18.95	---
	Barge to Guntersville, Ala. - truck beyond	34.82	26.30	---	34.96	27.98	---	35.86	32.16	---	34.82	26.30	---
	Barge to Chattanooga, Tenn. - rail beyond	59.72	18.94	---	55.94	19.20	---	48.39	18.91	---	59.72	19.31	---
	Barge to Chattanooga, Tenn. - truck beyond	35.22	26.08	---	35.20	27.72	---	35.78	31.88	---	35.22	26.08	---
	All rail	67.50	21.19	---	63.00	21.71	---	54.00	18.39	---	67.50	21.95	---

[1] The charges and costs include, in addition to transportation, any applicable grain handling at transfer points. They do not include handling at origin. Cost data covering handling, trucking, and barge operations on the New York State Barge Canal were not available. In the absence of these, handling expenses, table 27, are included in both charges and costs; trucking charges, shown graphically in figures 9 and 10, are included in charges and costs; and charges for grain transportation on the New York State Barge Canal also are included in computing the charges and the costs. The rail cost data reflect out-of-pocket costs and with rail charges are shown in table 34; for costs of moving grains in a Liberty vessel and in a lake-ocean bulk carrier, see tables 63, 64, and 65; and in an "upper laker," see tables 52, 53, and 54. Charges for "upper laker" and barge movements are shown in tables 41 and 43.

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[5] The vessel moves from the origin port loaded to 25 1/2-foot draft. Fill-out cargo is taken on at Montreal, Can., to bring the vessel down to full draft. It is assumed that the fill-out cargo for any particular vessel moved from the same origin, as the balance of the cargo, in an "upper laker" to Montreal. Costs for this movement are computed on a round-trip basis. These costs, together with handling charges at Montreal, are included in the total costs for movement from origin to destination.

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